E ENGINEERING CONSTRUCTION WEEKLY

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Engineering NEWS-RECORD

May 5, 1938

Work on Yellow River, China

BRIDGES · IRRIGATION · FLOOD CONTROL · FOUNDATIONS · DAMS ·

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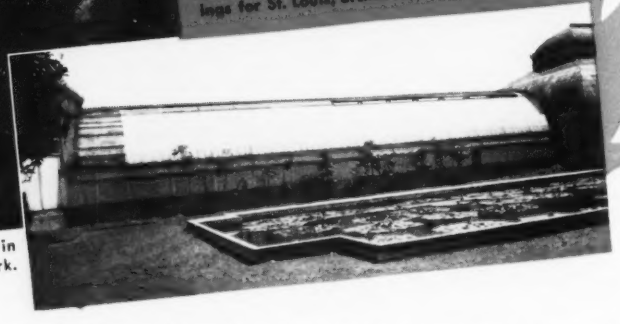
BYERS WROUGHT IRON

makes BEAUTIFUL GREENHOUSES more enduring

(LEFT) Byers Wrought Iron Pipe used for heating system steam and return lines, and water lines; also Byers Wrought Iron Plates, Sheets, Bars, and Angles used for the fabrication of window sections in "Jewel Box" Greenhouse, Forest Park, St. Louis, Mo. William C. E. Becker, Chief Engineer of Bridges and Buildings for St. Louis, architect.



(RIGHT) Byers Wrought Iron Pipe used for heating coils in New York Botanical Garden Greenhouse, Bronx Park.

• A fine greenhouse is a thing of beauty—and even though it cannot be a joy forever, its beauty can be made more enduring by the careful selection of materials.

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· ENGINEERING NEWS-RECORD ·

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VOL. 120 *MAY 5, 1938* No. 18

THIS WEEK AND NEXT

MILITARY ENGINEERS are keeping busy in China these days, but civil engineers must go elsewhere for work. There, the civil must sit back and watch the destruction or military use of his work—or go into the service himself. O. J. Todd outlines the status of engineering in war-torn China.

More concrete than Boulder, higher than Grand Coulee, Shasta Dam will be the highest gravity section dam in the world. It is to be the key element in the great Central Valley plan to utilize the abundance of water in northern California for replenishment of supply in the San Joaquin Valley to the south.

Almost 150 years of history lie behind the construction of the new 1,351-ft. continuous Potomac River Bridge at Washington, D. C. The famous "Chain Bridge" of the early 19th century gave the site its name.

Following a news account of the failure of a Belgian welded Vierendeel bridge in the issue of April 14, News-Record brings a more complete illustrated story of the collapse.

Florida's water supply problems occupied a large part of the program at the Am. Soc. C. E. spring meeting in Jacksonville.

Actual costs are compared with contract bid prices by an inquiring cost accountant in the service of the state of Oregon. Some results of his studies are published on page 660.

NEXT WEEK'S ISSUE will carry the report of the American Water Works Association at New Orleans; also an article on the difficult construction problem of removing the deep cofferdams at Grand Coulee Dam.

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THE COVER PICTURE shows a "Dragon's Net" ready to receive a plug for closing a break in the Yellow River dike system. War has brought a stop to engineering operations such as this and, according to Oliver J. Todd's statement in this issue, may result in wide damage throughout the War Zone.

Number of copies of this issue printed: 33,145

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THE WEEK'S EVENTS

Road Head Resigns In Connecticut

Macdonald resigns post after attacks by grand jury—Cox of Yale appointed

The resignation of John A. Macdonald as highway commissioner of Connecticut was requested and received by Governor Cross on April 29. On the same day the governor appointed William J. Cox, assistant professor of engineering mechanics at Yale, to the vacant commissionership.

The governor took his action after a grand jury investigating land purchases for the Merritt Parkway recommended Macdonald's "immediate removal" and said that the commissioner was "entirely to blame . . . for the greater portion of the waste, extravagance and incompetence exhibited in the purchase of the right-of-way for the Merritt highway."

New commissioner

Cox, who took office as commissioner on May 2, graduated from Washington and Lee University, receiving bachelor degrees in arts and civil engineering in 1917 and 1918 and the degree of C.E. ten years later. He served overseas as a second lieutenant of engineers during the war. Later he was engaged in highway work in the state of Kentucky and was for a short time on the staff of Charles T. Main, Inc. of Boston on building construction and highway work. He was employed by the J. A. P. Crisfield Contracting Co. on work for the Connecticut Light & Power Co. and was later with the National Board of Casualty and Surety Underwriters, in New York. He became an instructor at Yale in 1927.

Grand jury report

In recommending Macdonald's removal, the grand jury attacked his appointment without sufficient investigation of G. Leroy Kemp, now under indictment, as purchasing agent for the state and his failure to check on Kemp's activities after they had been brought to his attention. The jury charged Macdonald with failing to give personal supervision to parkway construction and land purchase, failure to leave his office prepared to deal with important matters during his frequent absences, and "apparent unwillingness on the witness stand to cooperate with the jury."

In connection with the land purchases, the jury some weeks ago indicted Kemp and has now indicted several other persons whose names have not yet been disclosed.

• • •

Bill Would Double Housing Fund

Bills to increase the authorized capital of the U. S. Housing Authority from $500,000,000, the present figure, to $1,000,000,000 were introduced April 26 by Senator Wagner and Representative Steagall. This exceeds the increase of $300,000,000 recommended in President Roosevelt's recent pump priming message.

U.S.H.A.'s present earmarkings total a little over $300,000,000, and its actual contracts are less than $60,000,000. A large volume of additional contracts, however, is in a preliminary stage. While it is doubtful if actual expenditures can reach the billion dollar mark for several years, an increased authorization would permit additional projects in some states now pushing close to the 10 per cent limit written into the original bill—particularly New York, Ohio and Pennsylvania.

MAJOR NEWS

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Cement Bids Asked In California

Procurement division asks bids on moderate-heat cement for delivery in California

Bids were invited April 30 by the Federal Procurement division for furnishing moderate-heat Portland cement in paper sacks for delivery in California. Bids were asked F.O.B. mill. The cement is for the use of departments of the Federal government in that state. Bids will be opened May 12.

Mills are asked to bid on a total of 250,000 barrels or on specified portions of this amount to be delivered on a particular schedule.

The government expects to take delivery of the cement over a period of six months at a rate of about 40,000 barrels per month. Mills may bid to deliver cement in any one of the 6 months. The maximum rate of delivery not to exceed 3,000 barrels per day.

The government expects to ask the first shipment of cement at the shipping point about June 15, and thereafter delivery will probably extend over a period of 5½ to 7½ months. Although a schedule of deliveries expected in each month is presented in the bid call the schedule is not guaranteed and the government reserves the right to increase or decrease the schedule as may be necessary.

A new call for bids to furnish all the government's requirements, over the next four months, for Portland cement is still being held up. It is understood that the delay is due to a decision to ask for bids and award contracts for definite quantities rather than attempt again to get bids on open contracts. Hence estimates of the amounts needed in various regions must be obtained before bids can be asked.

Coming on the first bid rejection, Sec. Morganthau admitted the validity of the objection that, under the conditions first prescribed, a manufacturer might be low bidder in his region and still receive no order under his contract. This he characterized as a "proposal that no business man who has any sense will accept." He did not feel that the industry was unalterably opposed to the mill-delivery price.

CNR Photo

TRANSPLANTED SWING SPAN FOR FREDERICTON BRIDGE

CENTER OF INTEREST in the reconstructed Fredericton Bridge of the Canadian National Ry. is the swing span, third from the right above. This span was obtained from an old C.N.R. bridge over the Red River at Winnipeg, Manitoba, and installed in the Fredericton bridge (*ENR*, Apr. 8, 1937, p. 533).

The Fredericton Bridge carries a single track across the St. John River in New Brunswick. An old bridge on this site was carried away by an ice jam in the flood of April, 1936, after being in use since 1884. The new bridge is shown as it neared completion in March.

Substructure contractors were the Richardson Construction Co. Ltd. of Toronto, and the superstructure was built by the Hamilton Bridge Co. Ltd. of Hamilton, Ont. F. C. Condron is chief engineer of the Atlantic region of the C.N.R. and C. E. S. Rogers is bridge engineer

Boulder Dam Engineer Goes to Shasta

Ralph Lowry, director and construction engineer on Boulder Dam since 1935 has been transferred to the Central Valley Project in California to become construction engineer of Shasta Dam, on which bids are now being advertised. Lowry's new appointment is part of a general modification of the administrative set-up of the Central Valley Project now being undertaken in preparation for the start of large-scale construction.

Roy M. Snell, who has been resident engineer in charge of the Kennett Division of the project during the period preliminary to construction of Shasta, will become Lowry's principal assistant.

Walker R. Young will continue in charge of the entire Central Valley Project with offices at Sacramento and will remain in administrative charge of all work in the Kennett Division, where Shasta Dam is located. On strictly engineering matters, however, Lowry will report direct to chief engineer Raymond F. Walter.

Since completing his studies at Washington State College in 1913 and a year as office engineer in the city engineer's office at Aberdeen, Wash., Lowry has been with the Bureau of Reclamation. He spent two years as office engineer on the Yakima project and five years in the design section of the Denver office. After work on the McKay, Gibson and Cle Elum dams, he went to Boulder in 1930 as field engineer, taking over in 1935 as construction engineer.

Snell is a graduate of the University of Maine, 1905. He was immediately employed by the Bureau of Reclamation and was project engineer on the Sun River project. His service, however, was interrupted in 1924 by ten years spent in the employ of the government of Porto Rico on irrigation and power projects. He reentered the service of the bureau in 1935 as resident engineer at Redding.

ENGINEERING CONSTRUCTION CONTRACTS REPORTED BY ENGINEERING NEWS-RECORD, IN APRIL, 1938

Engineering News Record *reports projects of the following minimum costs: Water-works, excavation, drainage and irrigation,* $15,000; *other public works,* $25,000; *industrial buildings,* $40,000; *other buildings,* $150,000.

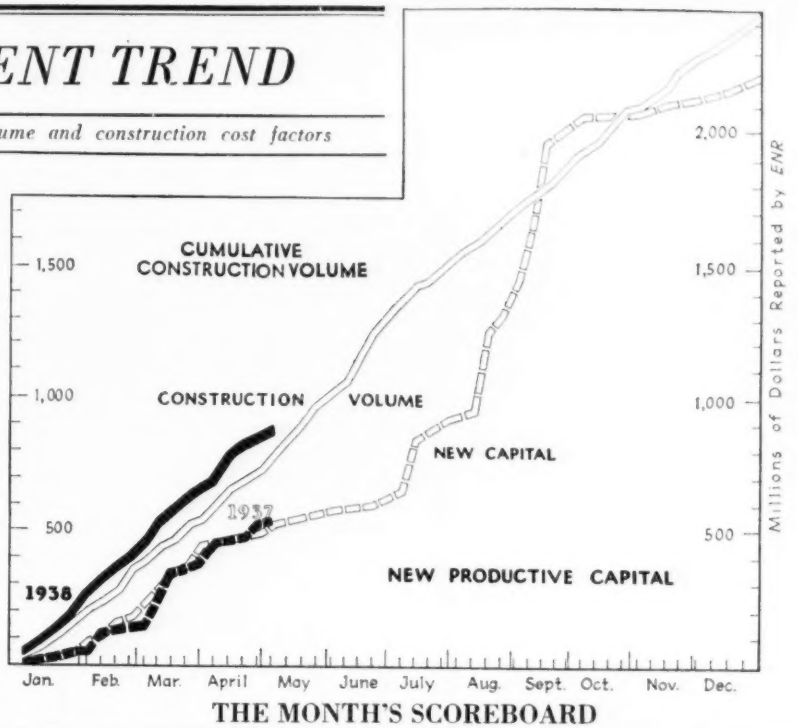
Four Weeks — Thousands of Dollars (000 Omitted)

	New England	Middle Atlantic	South	Middle West	West of Mississippi	Far West	United States April 1938	United States Four Montas 1938	United States Four Montas 1937	Canada
Public Works										
Waterworks	362	523	166	213	679	672	**2,615**	15,455	33,777	462
Sewerage	604	2,496	290	1,733	927	433	**6,483**	35,152	34,952	70
Bridges, public	332	3,376	937	797	1,819	862	**8,123**	26,423	34,116	388
Earthwork and waterways	18	1,886	220	6	6,317	1,305	**9,752**	84,741	30,827	87
Streets and roads	1,546	10,015	7,153	8,403	12,527	4,164	**43,808**	137,757	97,322	661
Buildings, public	.....	9,271	1,950	2,569	3,074	1,303	**18,167**	131,261	99,082	170
Unclassified, public	449	4,910	1,952	489	1,608	765	**10,173**	35,924	37,044	561
Total public	**3,311**	**32,477**	**12,668**	**14,210**	**26,951**	**9,504**	**99,121**	**466,713**	**367,120**	2,399
Federal government (included in above classifications)	52	1,786	666	301	4,650	1,466	**8,921**	88,938	60,860	.....
Private										
Bridges, private	.....	.....	.....	.....	.....	.....	.....	2,486	2,900	.....
Buildings, industrial	1,335	1,910	509	835	1,162	815	**6,566**	64,732	152,088	4,520
Buildings, commercial	5,591	58,944	1,250	4,832	6,535	2,911	**80,063**	275,294	129,642	1,800
Unclassified, private	1,169	1,147	388	255	3,086	1,579	**7,624**	38,834	84,267	350
Total private	**8,095**	**62,001**	**2,147**	**5,922**	**10,783**	**5,305**	**94,253**	**381,346**	**368,897**	6,670
Total Engineering Construction										
April, 1938 (4 weeks)	**11,406**	**94,478**	**14,815**	**20,132**	**37,734**	**14,809**	**193,374**	.....	.....	9,069
March, 1938 (5 weeks)	11,575	127,592*	25,157	28,995	36,266	25,433	**255,018***	.....	.....	7,352
April, 1937 (5 weeks)	12,685	83,686	18,681	44,293	33,447	24,163	**216,955**	.....	.....	15,341
Four Months — 1938	34,641	388,156	79,557	97,472	140,247	107,986	.....	848,059	.....	21,981
Four Months — 1937	35,785	322,512	65,045	125,902	107,800	78,973	.....	.....	736,017	33,804

*Revised

THE CURRENT TREND

This week's news of contract volume and construction cost factors



THIS WEEK'S FIGURES

(Thousands of Dollars)

CONTRACTS

	Week Ending May 6 1937	Apr. 28 1938	May 5 1938
Federal	$1,949	$1,043	$2,625
State & Municipal	31,228	19,102*	18,128
Total public	$33,177	$20,145*	$20,753
Total private	26,274	14,875	15,569
TOTALS	$59,451	$35,020*	$36,322

Cumulative
1938 (18 weeks).....$884,381*
1937 (18 weeks).....$795,468

Note: Minimum size projects included are: Waterworks and waterways projects, $15,000; other public works, $25,000; industrial buildings, $40,000; other buildings, $150,000.

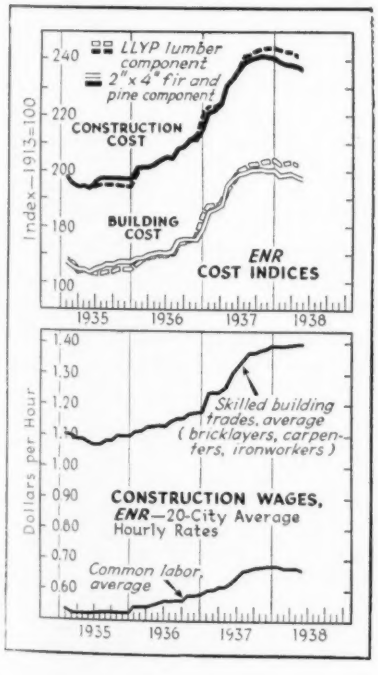
*Revised totals.

NEW PRODUCTIVE CAPITAL

	Cumulative 1937 18 Wk.	1938 18 Wk.
NON-FEDERAL	$514,409	$439,495
State & Mun. bonds	209,725	219,303
Corporate securities	226,167	101,250
PWA loans, grants	48,578	2,029
RFC loans	29,939	63,420
U.S.H.A. loans	... .	53,493
FEDERAL	.....	$86,532
TOTAL CAPITAL	$514,409	$526,027

ENR INDEX NUMBERS

Base = 100	CONSTRUCTION COST 1913	1926	BUILDING COST '13	'26	VOLUME '13	'26
May 1938..	236.80	113.83	197.86	106.95	...	...
Apr., 1938	237.95	114.38	198.21	107.15	176	77
Mar, 1938	238.79	114.79	199.29	107.75	188	82
May 1937..	233.45	111.98	197.15	106.55	214	94
Apr., 1937	231.35	111.16	194.95	105.40	160	70
1937 (av.)..	234.71	112.66	196.15	106.07	172	75
1936 (av.)..	206.42	99.15	172.18	93.14	185	81
1935 (av.)..	196.44	94.43	165.76	89.65	134	59



THE MONTH'S SCOREBOARD

CONSTRUCTION VOLUME & NEW PRODUCTIVE CAPITAL

(,000 omitted)	April 1937*	1938	% Change	Four months 1937	1938	% Change
Total Construction (*ENR*)	$216,955	$193,374†	+11	$736,017	$848,059†	+15
Private	112,073	94,253	+ 5	368,897	381,346†	+ 3
Public	104,882	99,121†	+18	367,120	466,713†	+27
Federal	16,121	8,921	—31	60,860	88,938	+46
Total New Productive Capital (*ENR*)	$109,976	$147,316	+67	$487,470	$518,369	+ 6
Private Investment	79,278	18,601	—71	410,203	312,895	—24
Federal (non-federal work)	30,698	42,183	+72	77,267	118,942	+54
Federal (federal work)	.....	86,532	..	.....	86,532	..

* 5-week month. † Revised totals.

CONSTRUCTION COSTS . . . WAGE RATES . . . PRICES

	May 1937	1938	% Change	1937 Apr.	May	% Change Apr. to May	1938 Apr.	May	%
ENR Construction Cost Index, 1913 = 100	233.45	236.80	+1.5	231.35	233.45	+1.0	237.95	236.80	—0.5
ENR Building Cost Index, 1913 = 100	197.15	197.86	+0.4	194.95	197.15	+1.1	198.21	197.86	—0.2
ENR 20-CITIES' AVERAGE									
Common Labor	$0.627	$0.673	+7.3	$0.612	$0.627	+2.4	$0.677	$0.673	—0.6
Skilled Labor (Av. 3 Trades)	1.302	1.399	+7.4	1.258	1.302	+3.5	1.399	1.399	0
Bricklayers	1.397	1.486	+6.4	1.332	1.397	+4.9	1.486	1.486	0
Struct. Ironworkers	1.342	1.448	+7.9	1.320	1.342	+1.7	1.448	1.448	0
Carpenters	1.166	1.263	+8.3	1.123	1.166	+3.8	1.263	1.263	0
Cement, per bbl	$2.53	$2.55	+0.8	$2.53	$2.53	0	$2.55	$2.55	0
Reinforcing Steel, new billet	2.88	2.89	+0.3	2.88	2.88	0	2.88	2.89	+0.3
Struct. Steel, Pittsburgh	2.25	2.25	0	2.25	2.25	0	2.25	2.25	0
Sand, per ton	1.16	1.28	+10.4	1.19	1.16	—2.5	1.29	1.28	—0.8
Lumber, 2x4 Fir, per M Ft.	38.35	32.32	—15.8	39.50	38.35	—3.0	32.90	32.32	—1.8
Lumber, 2x4 Pine, per M Ft.	33.69	28.00	—16.9	34.28	33.69	—1.7	28.06	28.00	—0.2
Brick, common, per M	14.15	14.14	—0.1	14.05	14.15	+0.7	14.20	14.14	—0.4
Ready-mixed Concrete, c. y.	7.29	7.26	—0.4	7.22	7.29	+1.0	7.34	7.26	—1.1
Struct. Clay Tile, 3x12x12	73.81	73.76	—0.1	73.18	73.81	+0.9	73.91	73.76	—0.2
Paving Asphalt, cars, ton	17.32	16.24	—6.2	17.27	17.32	+0.3	16.40	16.24	—1.0

MATERIAL SHIPMENTS . . . BUILDING PERMITS

	April 1937	1938	% Change	Mar. 1938	% Change Mar.-Apr.
Lumber (% 1929 wk. av.) N.L.M.A.	74.0	56.3	—24.0	57.0	—1.2
Steel (% operating capacity) A.I.S.I.	90.9	32.4	—64.4	32.3	+0.3

	March 1937	1938	% Change	Three months 1937	1938	% Change
Fabricated Struct. Steel, (A.I.S.C.)	142,995	100,956	—29.4	345,125	268,287	—22.2
Cement, thous. bbl. (U.S.B. of M.)	7,879	7,259	—7.9	17,731	16,224	—8.5
Building Permits, Dun & Bradstreet, (,000 omitted)	$121,119	$76,599	—36.8	$275,460	$277,475	+0.7

RENT INDEX . . . EMPLOYMENT

	March 1937	1938	% Change	Feb. 1938	% Change Feb.-Mar.
Rent (Housing) Index, N.I.C.B.	84.2	87.5	+3.9	87.8	—0.3
Trade Unions, % Employed, A. F. L.	87.0	79.0	—9.1	79.0	0
Building Trades, % Employed A. F. L.	71.0	55.0	—22.5	57.0	—3.6

A.W.W.A. Constitution To Be Modified

Two new grades of membership are set up and new office of vice-president is created

Changes in the constitution of the American Water Works Association establishing two new grades of membership—junior and affiliate—and creating the office of vice-president were given approval at the convention of the association in New Orleans, April 24-28. The new memberships are designed to encourage participation of young men and operators of small plants in the activities of the association.

Registration at the convention numbered nearly 1,150, the largest since the 1929 meeting at Toronto.

Reeves J. Newsom, New York consulting engineer, was elected president to succeed Eugene F. Dugger, general manager of the Newport News, Va. Water Works Commission. William W. Brush, editor of *Water Works Engineering*, was re-elected as treasurer.

Air conditioning discussed

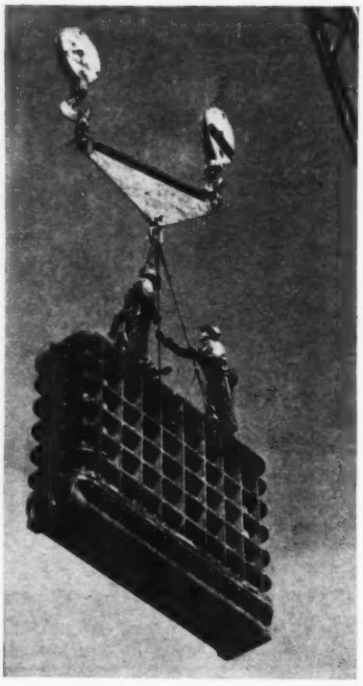
More than 100 papers were read at the technical session. Special attention was given to the demands on water supply created by air conditioning. Data from some cities indicated that requirements ranged from 11 to 20 per cent of delivery capacity. On the basis of a water consumption survey of 434 cities with a population greater than 20,000, O. C. Holleran of the U. S. Department of Commerce, reported that "The danger of over-demand from air conditioning equipment which appeared so serious a year ago has been markedly reduced in seriousness during the past season."

Meter specifications

Revision of the A.W.W.A. meter specifications to make them more definite and complete was urged as a means of ending "cut-throat competition" in the meter field. Manufacturers' standards were said to be far more accurate than the 16-year-old association specifications.

The final draft of a complete waterworks accounting manual was submitted by the finance and accounting division. The manual is sponsored jointly by the Municipal Officers Finance Association and the A.W.W.A.

Papers on corrosion control, plant operation and management problems were also presented. A complete report of the meeting, including technical discussions, will be published in next week's issue.



Bureau of Reclamation photo

LOWER AWAY

SIXTEEN TONS of value are swung into place at Grand Coulee. Shown here is one of four sections which will make up a 100-ton valve to control the flow of water to outlet tunnels in the base of the dam. Twenty pairs of such valves will control the flow through the base of the dam, and 41 pairs will be installed in similar tunnels at higher levels.

New Channel Finished For Harlem River

The new cutoff channel for the Harlem River ship canal, New York City, through the Spuyten Duyvil peninsula has been completed about a year ahead of contract time. Work on the canal was started in October, 1936, and it was to have been completed May 8, 1939.

The new channel eliminates a hairpin curve in the canal and permits the river to run nearly in a straight line between the Broadway bridge and the new Henry Hudson parkway bridge. The old channel and the adjoining marshes will be filled in by the park department and added to the existing area of Inwood and Spuyten Duyvil parks.

The work was done by the Arundel Corp. of Baltimore, with the federal government paying the cost of the new channel and the state acquiring the land.

The new channel is 400 ft. wide and has a minimum depth of 15 ft.

Failure of Old Building Kills Twenty-Four

The collapse on April 21 of a [illegible] year old two-story brick building in Phenix City, Ala., killed 24 people and injured 83. The two-story building, which housed a liquor store, had brick walls and a corrugated roof with interior iron columns supporting floors and roof. The building collapsed suddenly when the east wall gave way bringing down the roof and heavy timbers.

The failure is attributed by building inspector Leonard Ray to weakening of the foundation by rain.

About 200 people were in the building at the time of the failure. Cracking of timbers gave warning of the impending collapse, enabling about half of them to escape.

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Housing Funds Earmarked For San Francisco

Earmarking $55,000,000 of housing funds for 19 cities, Nathan Straus, administrator of the U. S. Housing Authority, brought to $310,998,000 the total funds set aside for slum clearance and low rent housing programs in 77 communities.

Largest of the new earmarkings was $15,000,000 for San Francisco, and this with ten other earmarkings made $25,300,000 for communities not previously participating in the program. An additional allotment of $10,000,000 for New Orleans brought the amount available to that city to $18,411,000.

The present earmarking marks the first participation in the program of communities in California, Montana, New Jersey and North Carolina.

Commenting on this assignment of funds, Straus said, "If the demands of local housing authorities for earmarkings continue at the present rate, the entire $500,000,000 now available for earmarkings under the United States Housing Act of 1937 should be exhausted by June 1."

Boston project opened

Tenants started moving into Old Harbor Village, $6,636,000 project in Boston, on May 1, as complete operation and management of the project was turned over to the Boston Housing Authority.

Under the terms of a lease expiring Dec. 31, the Boston Authority agrees to pay U.S.H.A. $43,428 per year as rent and to remit to the city of Boston $15,000 per year in lieu of taxes. Average shelter rental paid by tenants in this project is $4.93 per room per month.

Overpass Is Damaged By Coast Landslide

A landslide involving 15,000 cu.yd. of material has destroyed the east span of the Galivan overhead grade separation on the coastal highway from Los Angeles to San Diego. The slide occurred when a stratum of clayey shale running through the hillside became water-soaked in the rain of April 6. Material resting on the stratum cracked in three places and started to slough down two days later. Ditches have drained out most of the water and movement has now nearly stopped.

In addition to the damage to the overhead crossing, the concrete retaining wall on the side of the Santa Fe Railway cut was cracked, and pressure from below moved the track about 3 ft. horizontally and 1 ft. vertically. Crews were put to work promptly and railway service was not interrupted. A highway detour involving a grade crossing some distance north of the overhead is now in use.

The state division of highways has approved plans for grading back the unstable hillside on a 2 to 1 slope with a tile drainage ditch about halfway up as well as for rebuilding the broken span.

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River and Harbor Projects Approved by House

An omnibus river and harbor bill authorizing construction of 39 new projects at an estimated cost to the federal government of $33,904,000 was passed April 27 by the House of Representatives, and now goes to the Senate for consideration. Composed chiefly of minor improvements, it includes a few large projects as follows:

Delaware River, Philadelphia to the sea	$11,000,000
Houston Ship Channel and Buffalo Bayou, Tex.	9,000,000
Sabine-Neches waterway, Tex.	4,320,000
Hudson River, N. Y.	3,102,000

All of the 39 projects have been approved by the Chief of Engineers and the Board of Engineers for Rivers and Harbors.

In presenting the bill Rep. Mansfield of Texas remarked that since 1824, when Congress started to improve navigable waters, the federal government has spent $2,244,632,000 of which $955,482,000 has been expended during the last ten years—approximately $400,000,000 of this from relief funds during the past four years. Total waterway commerce for the last year for which complete figures are available—1936—was 525,842,000 tons with a total valuation of $17,448,000,000.

Lee Grover Honored For Highway Service

One thousand friends and associates of A. Lee Grover, secretary, New Jersey State Highway Department, attended a dinner at Trenton on Apr. 30 to celebrate the completion of his first 25 years with the department and the start of his second. Mr. Grover entered the highway department Apr. 15, 1913, and for most of the time since that date he has held the position of secretary and chief clerk.

Engineers and contractors and equipment, material, and surety men from all over the East gave him a rousing welcome as he entered the banquet hall. Glowing tributes were paid him for his long and faithful service by toastmaster Harold G. Hoffman, highway commissioner E. D. Sterner, chief engineer Jas. Logan and other speakers. Several of the speakers referred to Mr. Grover's service as the longest of any state highway official.

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Colonel Ridley Promoted To Brigadier-General

Col. Clarence F. Ridley of the U. S. Engineer Corps, now governor of the Panama Canal, has been appointed brigadier-general of the line.

Colonel Ridley graduated from West Point in 1905 and served for the next ten years in the Corps of Engineers at various stations in the United States, Cuba, Hawaii, and the Philippines. During the war he served in Washington as military aide to President Wilson.

Since the war, Colonel Ridley has spent about nine years in the Panama Canal Zone, as engineer of maintenance and since 1936 as governor.

Less Construction By WPA Asked

Wisconsin contractors protest concentration of relief projects on construction

A protest against concentration by WPA on construction work "in which it employs approximately 85 per cent of its workers" was registered by a statewide construction industry conference of Wisconsin in Milwaukee April 20.

The Wisconsin contractors asserted that "the time has arrived when relief of unemployment by government subsidy must be recognized as a permanent program" and urged that the program be restudied and reorganized on that basis. They held that the practice of putting men from all walks of life on construction projects was unjust to relief workers because it required them to spend years apprenticed to an industry in which they will be unable to find a livelihood in the future. In addition, skilled non-construction workers when placed on construction projects are rated as unskilled common labor and receive lower rates of pay.

Construction wages reduced

The system, they said, is also unjust to construction workers because it reduces the amount of available private construction employment and because construction wage rates are forced down by the efforts of men employed for 55 hours a month on WPA to obtain supplementary employment at any rate they can get.

Further, the contractors asserted, costs of construction under WPA are higher than by contract, and easy receipt of money from Washington tends to induce a disregard of economy in local officials.

Recommendations

In general, the contractors recommended that instead of concentrating on construction projects, WPA should arrange to employ all relief workers on projects connected with the industry in which they were normally employed. Such projects, it was asserted, could be set up in cooperation with the various industries as a means of preserving the skills each industry requires of its workers.

WPA funds, moreover, should be distributed to the states on PWA and federal highway aid principles, with the states required to match federal funds, the contractors held.

Relief of unemployed construction workers should not be effected by a WPA type of program but by a revival and an extension of the PWA program.

WASHINGTON HIGHLIGHTS

Special reports by Paul Wooton

THE TVA INVESTIGATING COMMITTEE at its first meeting on April 26 selected Senator Donahey of Ohio as chairman and Representative Meade of New York as vice chairman. Committee members indicated that it would be several weeks before formal hearings began, as they plan to send investigators into the Tennessee Valley area.

FOLLOWING oral argument on the right of the federal government to intervene in the pending suit between the state of Nebraska and the states of Wyoming and Colorado over the division of the waters of the North Platte River, Chief Justice Hughes on May 2 instructed counsel for the federal government and the three states involved to draw up an order setting forth the basis of the intervention for presentation to the special master in charge of the case.

The case has aroused much interest because, in his plea for permission to intervene, the Attorney-General claimed ownership of all unappropriated waters in the western part of the country for the federal government.

A TEN-YEAR federal building program for the District of Columbia involving a total expenditure of $140,000,000 was recommended to President Roosevelt April 29 by a special committee that has been studying present and prospective needs of the government for office space.

Major items in the recommendations included $26,000,000 for a new War Department building, $11,525,000 for a Social Security Board building, $16,800,000 to provide new administrative quarters for the Navy, $4,500,000 for an additional central heating plant, and $51,940,000 for various structures needed by the district of Columbia government.

THREE South Carolina utility companies asked the U. S. Supreme Court on April 29 to review a decision of the Fourth Circuit Court of Appeals dismissing their application for an injunction against construction of the Santee-Cooper navigation, flood control, and power project by the South Carolina Public Service Authority with the aid of federal funds. The companies are Carolina Power and Light, South Carolina Power, and South Carolina Electric and Gas Co. They contend that "the construction, maintenance and operation of the project by the state agency is itself illegal," and also contest the use of federal money in building facilities that will compete with them.

The Santee-Cooper project involves the diversion of water from the Santee River to the Cooper River through an abandoned canal, and includes two reservoirs totalling 1,400,000 acre-ft., a power house with eight 25,000 kva. generators, and about 600 miles of transmission line, at a total estimated cost of $37,500,000.

THE SENATE appropriations committee on April 26 reported the War Department non-military appropriation bill, which carries funds for navigation and flood control improvements. The Senate committee added approximately $30,000,000 to the measure, of which $25,000,000 was added to the rivers and harbors fund to provide for additional projects.

THE HOUSE foreign affairs committee on April 26 reported favorably a resolution authorizing the President to invite the International Union of Geodesy and Geophysics to hold its seventh general assembly in the United States in 1939; another authorized a $15,000 appropriation to cover the expenses of American participation in the third Pan-American Highway Conference, to be held next year in Chile.

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Milwaukee Awards Cement Contract

The city of Milwaukee has awarded a contract for 1,000 barrels of cement to meet its needs for the next four months, which it was holding up pending the result of the federal government's new cement-purchasing procedure (*ENR*, April 28, 1938, p. 604).

The contract was awarded to the Norman J. Pitkorn Co. Pitkorn offered a bid of $2.44 a barrel for cement in paper bags, with a 4 per cent discount for cash; all other bids were uniform at $2.50 a barrel.

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Arkport Dam Contract Goes to Albrecht

Initiating a flood control program in south central New York State, which suffered severely in the floods of 1935, the U. S. Engineers have awarded contract for construction of an earth dam on the Canisteo River at Arkport, N. Y. to E. J. Albrecht Co. of Chicago.

The Albrecht bid of $1,027,000 was the lowest of seventeen and was $325,000 under the estimate of the U. S. Engineers.

Second Lincoln Tube Is Holed Through

Unprecedented operation of driving alongside existing tube completed without mishap

The north tube of the Lincoln vehicular tunnel under the Hudson River between Weehawken, N. J., and 38th St., Manhattan, was holed through with appropriate ceremonies on May 2, thus completing the tenth underwater connection between the two states. Driving of the second tunnel was unprecedented in that the 31-ft. shield pushed through 5,060 ft. of the river silt only 44 ft. away from the first tube, now in service for several months, and which was holed through in August, 1935 (*ENR*, Aug. 8, 1935, p. 204). In both tunnels the New Jersey shields traveled the full width of the river, ending in steel caissons sunk at the New York shore line as the foundations of ventilating towers. The New York shields drove through the land approaches only, also ending in the caissons.

On the underwater sections the shields were driven "blind." That is the muck was shoved ahead and only just enough silt to provide ballast for the bare tube was admitted through bulkhead gates in the face. On the first, or south, tube about 20 per cent of the displaced muck was admitted into the shield. Fearing a possible disturbance of the completed bore from sidethrust, the engineers directed that 50 per cent of the muck be admitted into the second tube shield at first. However, as no appreciable movement of the first tube developed, the amount of muck admitted was gradually reduced to 20 per cent. A daily average speed of 30 ft. of tunnel was maintained on the first tube; the driving on the second tunnel averaged 29.6 ft. per day. The maximum movement of the south tunnel from north tunnel operations was only ¾ in., regarded by the engineers as of no consequence.

First through the 24-in. pipe driven ahead to connect the shield and caisson were several burly sandhogs from the New Jersey side who had staged a battle royal for the privilege. Harry Stribling, general superintendent, Mr. Crandall, and James Forgie, veteran consulting engineer, followed.

The Lincoln Tunnel is being built by the Port of New York Authority under the immediate direction of C. S. Gleim, construction engineer, and Chas. Crandall, resident engineer. Contracts of both subaqueous sections were held by Mason & Hanger, Inc., of New York City. Miles Killmer, general manager, and Howard L. King, chief engineer, are in charge for the contractor.

New Revenue Sources For Reclamation

Congress approves transmission lines for Bonneville Dam power

The Interior Department Appropriation bill as given final approval by Congress amends the Reclamation Act to provide new sources of revenue for the Reclamation Fund. The bill provides funds for continuing work on a number of federal power and irrigation projects, on the Blue Ridge and Natchez Trace parkways and for construction of transmission lines in the Bonneville area.

To replenish the depleted Reclamation Fund, Congress incorporated in the measure an amendment to the Reclamation Act dedicating to the fund 52½ per cent of revenue received from the sale of oil from naval reserve lands and providing that receipts from the sale of water and power on reclamation projects built with relief funds shall be covered into the Reclamation Fund. Power revenues, however, after the cost allocated to power shall have been amortized, will go into the Treasury.

Inasmuch as the first section of this amendment is made retroactive, it will result in an immediate transfer to the Reclamation Fund of $29,000,000, of which $15,000,000, however, will be used to repay advances which the Treasury has made to the Reclamation Fund.

Direct appropriations include $3,500,000 to the Bonneville administrator for the construction of transmission lines to distribute Bonneville power. A double-circuit line on steel towers will be built from Bonneville to Vancouver, Wash., from which point wood-pole lines will extend north to Kelso, Wash., and south to Portland, Ore. There will also be a steel tower line from Bonneville toward Conduit, Wash., a wood-pole line to The Dalles, and lines for industrial service in the vicinity of the Bonneville plant.

For the continuation of construction on the Blue Ridge and Natchez Trace parkways the bill carries $5,000,000, a compromise between the $3,996,200 approved by the House and the $5,996,200 approved by the Senate.

A total of $38,740,000 was appropriated for reclamation work, divided as follows: $9,760,000 for projects under the Reclamation Fund; $3,500,000 for electrical equipment at Boulder Dam; $500,000 for the All-American Canal; $21,980,000 from general funds to continue work started outside the Fund, including Grand Coulee ($13,000,000) and Central Valley ($9,000,000).

Congress Approves Power At Fort Peck Dam

Installation of electric generating machinery at Fort Peck Dam on the Missouri River in Montana as rapidly as a market for power can be developed was authorized in a bill passed by the House of Representatives May 2. The ultimate installation authorized would cost $6,800,000.

The bill was passed by the Senate in July of last year. In the Senate version, however, an administrator would be placed in charge of the marketing of power, with the Corps of Engineers handling construction, maintenance and operation of the project. The present House version likewise divides authority, but includes an amendment placing power distribution under the Bureau of Reclamation rather than an administrator.

The bill now goes back to the Senate for action on the House amendment.

• • •

Florida Cement Tax Is Enjoined

A permanent injunction against collection by the Florida state highway department of an inspection tax of $2 per ton on imports of foreign cement at Florida ports was issued April 21 by the U. S. district court. A temporary injunction was issued last November (*ENR*, Dec. 9, 1937, p. 920).

The tax was placed by the 1937 session of the state legislature and was upheld by the Florida Supreme Court as a valid fee for inspection (*ENR*, Oct. 21, 1937, p. 656). Subsequently the tax was attacked in the federal courts by the Bimco Trading Co., a New York firm importing cement from Belgium and Denmark. The federal government intervened in the case, asserting that the tax reduced the reciprocal advantages granted under the Belgo-Luxemberg trade treaty of 1935, under which this country granted a 1½ cents per 100 lb. tariff reduction on Belgian and other cements in return for tariff concessions on products of this country.

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Registration Bill Signed In Rhode Island

A bill requiring registration and licensing of engineers and land surveyors in Rhode Island was signed by the governor on April 23.

Enactment of the Rhode Island measure brings to forty the number of states now requiring licensing of engineers.

LABOR NOTES

THE DISPUTE between the St. Louis Building Trades Council and the Independent Workers Organization as to recognition on a St. Charles, Mo., bridge repair project which shut down that job and caused a brief general strike on federal projects (*ENR*, April 28, 1938, p. 605) was settled April 28 when the Building Trades Council and the I.W.O. agreed that A.F.L. unions furnish skilled workers and half the common labor on the project and the I.W.O. furnish the rest of the common labor. In addition, the I.W.O. was to have been permitted to furnish men for reservoir clearing operations above Alton Dam which were shut down some time ago as the result of labor difficulties. This project, however, appears to have been permanently dropped.

NEW TROUBLE appeared in prospect, however, in St. Louis, as the Building Trades Council protested against use of WPA labor on a $600,000 reconstruction program at Jefferson Barracks. The council charged that WPA workers are doing plastering, plumbing and electrical work for 88 cents on which union scales are $1.50 to $1.75 an hour, and threatened a new general strike on federal projects around St. Louis.

CINCINNATI unions have joined with contractors there to ask city manager Sherrill to have public improvements to highways, sewers, and water lines done under contract instead of by WPA labor.

BUILDING TRADE laborers in California will be paid 81 cents an hour for a 40-hour five-day week under a new agreement between the Central California chapter of the Associated General Contractors and the Construction and General Laborers Union and the International Hodcarriers Building and Common Laborers Union. The agreement provides for overtime at the rate of time and a half up to four hours and double time thereafter. Two-shift operation is permitted. The agreement also sets up a joint conference board for settlement of disputes and prohibits work stoppages.

BRICKLAYERS on a PWA school construction project at Mayfield High School went on strike April 27 for union recognition and an increase of wages from $1.10 to $1.50. Gorrell & Sons, the contractors, has asked PWA to certify new workers to replace those on strike.

Further news on page 663

COMMENT AND DISCUSSION

Readers' opinions on matters that concern the engineer

License Law Changes

Sir: New Jersey has had an engineer's license law on its statute books since 1921 under which 3,700 engineers have been licensed to practice. In that act, professional engineering is defined as "the practice of the professional engineer who, through technical knowledge gained by education and experience in *one* or more branches of that profession, initiates, investigates, plans and directs the application of the resources of nature to the use and convenience of man." The qualifications call for "six or more years of active engagement in professional engineering work, one of which shall have been in responsible charge of work."

It is now proposed to change this law, and a new law, Assembly Bill 507, has passed its second reading in the House. This new law provides that it shall be unlawful for any person to practice professional engineering unless duly licensed under the new act, and the act provides that the applicant for a license must produce evidence satisfactory to the licensing board that he is able to qualify under the new act. The new act defines engineering practice as follows: "The practice of professional engineering, within the meaning and intent of this chapter, includes any professional service, such as consultation, investigation, evaluation, planning, design, or responsible supervision of construction or operation in connection with any public or private utilities, structures, buildings, machines, equipment, processes, works or projects, wherein the public welfare, or the safeguarding of life, health, or property is concerned or involved, when such service requires the application of engineering principles and data."

An applicant, to comply with all these requirements, if the board so rules, would have to pass examinations in *civil, electrical, mechanical,* and *chemical* engineering. Under the present law, an engineer has only to be proficient in *one* branch of engineering and have an actual experience of six years, one of which has been in responsible charge of work, in order to be sure of his license. Under the proposed law he has no security whatever and must depend absolutely on the favor of the board.

What about the present 3,700 registered engineers? The new law does not contemplate licensing as *professional engineers* all engineers now registered under their several classifications. What it says, "All professional engineers licensed by this board prior to the passage of this chapter shall continue to practice under the *various classifications heretofore granted* or may, upon application therefor, receive a new certificate under the title 'professional engineer', provided said professional engineer presents evidence satisfactory to the board of his qualifications to practice in the field of general engineering comprehended in the title 'professional engineer.' "

This paragraph puts all the registered engineers on the same plane as the new applicant. Each must stand that all-embracing examination in order to be registered.

The new law seems to injure the engineers now registered under their several classifications in two ways. In the first place, the new law provides that "no department, institution, commission, board or body of the state government, or any political subdivision thereof, shall designate, appoint, or employ an engineer in responsible charge other than a duly qualified *professional engineer* who has been licensed by the state of New Jersey prior to such appointment." The law includes an exemption for those already licensed, but only for appointment to the *same office* as they held at the time they were licensed. It appears to shut them out for any promotion to a better office.

In the second place, a companion bill which relates to the appointment of a city engineer by the mayor of a city (Assembly Bill 508) states that upon adoption of Bill 507 calling for the licensing of *professional engineers* the term *civil engineer* in the present statute becomes "inconsistent and meaningless." If it is possible by law to abolish the title of civil engineer, what will prevent another law, introduced next week or next year, from legislating every other engineering title out of existence?

What is the object of this law? I believe it to be a hidden political power trying to capture the engineering profession of the state of New Jersey. Any combination that can control three of the five members of the state board can dictate to the whole engineering profession of the state if Bill 507 and the bills that will undoubtedly follow it become law.

E. E. KELLER
Registered Civil Engineer and Land Surveyor
Merchantville, N. J., April 16, 1938

Cracks in Brick Walls

Sir: In *Engineering News-Record* of April 14, p. 529 is a letter regarding deflection of solid concrete slabs in federal housing projects. The reasoning of Prof. Bart J. Shine is open to criticism with regard to cracks in brick work.

If his deflection theory reflects observed conditions of horizontal cracks, then obviously the side walls on many or all buildings, at all floors, should be cracked in a similar manner, and below the slab line as shown in his sketch. The facts, however, do not uphold this theory. The cracks where they occur are near the roof line or parapet and at the ends of the longest buildings. The cracks also occur above the slab.

Water-proof felt paper has been used at the wall and mopped on to the concrete slab. In some specifications this membrane is made to extend down to the window lintel. At the roof line a membrane is used for flashing. This feature, while desirable, is accompanied by some difficulty when frost action is considered together with stretching of the brick wall. Brick laid in cement mortar has approximately the same coefficient of expansion as a concrete slab.

When a brick wall 200 ft. long expands or contracts due to a range in temperature from perhaps 85 deg. inside to 15 to 20 deg. outside it will probably tend to slide along the concrete slab on which two-thirds of its weight rests. If the friction developed by the load above and the wall's own weight is enough to resist this sliding, the wall may crack along one of several bonding joints. The brick and tile wall in this case is 12½ in.

thick, with bonding joints approximately 11 in. apart, vertically. The pargetting of the face brick prevents complete action as a unit of 12½ in., hence the cracks will appear along the line of the bonding courses. This statement is borne out when considering the appearance of a few white plaster cracks and also the outer cracks in the brick work.

The cracking of the brick work may be accentuated by rain freezing in the cracks, especially along the water-proofing membranes. Another consideration is the fact that if and when these cracks occur, the crumbling masonry dust and sand crystals are deposited behind the pargetting, preventing a return and closing up, thus setting up a progressive disintegration.

THEO. H. NIERMANN
Civil Engineer and Architect
Cincinnati, Ohio, Apr. 21, 1938

Verde River Flood

Sir: The recent flood at Bartlett Dam on the Verde River, about 25 miles above the mouth of the stream near Granite Reef, Arizona and some 60 miles up the valley from Phoenix, can hardly be classed as an "impossible" flood in view of the records available on the Verde and neighboring streams in this region. In view of the extensive drainage area of 5,600 sq. mi. above the Bartlett Dam site, the 90,000 sec.-ft. flood of February, 1937, rated only 12 per cent on the Myers scale; and even if the March, 1938, flood attained a peak discharge of 120,000 sec. ft. instead of merely approaching it, as reported in your issue of April 14, 1938, p. 548, the rating would have been only 16 per cent.

Published official records, as tabulated herewith, show that in several instances, during the past 33 years, the rating of 12 per cent has been attained or exceeded due to flood runoff from nearly comparable drainage areas. The San Pedro River, for example, at Charleston, Ariz., near the Mexican border, attained a rating of slightly more than 25 per cent, and as recently as Sept., 1926.

Due to the flashiness of streamflow from semi-arid regions and to the relatively small number of gaging stations, it is probable that many of the torrential flood crests resulting from cloudbursts escape official observation and appraisal. Only when the resulting damage attains serious proportions, or when life as well as property is threatened, do such sudden floods of brief duration become items of record.

An example was afforded by the Cave Creek flood of August, 1921, which inundated the state capitol grounds at Phoenix. The normally dry channel of Cave Creek discharged an estimated 25,000 sec.-ft. from 200 sq. mi. of drainage area near the close of an unusually dry summer season. While the officially recorded rainfall for the entire year of 1921 at Phoenix was only 3.85 in., 1.2 in. of which fell during the month of August, it is practically certain that considerably greater depths of rainfall would have been recorded if a rain gage had been maintained in the foothills drained by Cave Creek. Naturally, the long-advocated project for the Cave Creek Dam and detention reservoir became a reality soon thereafter.

Your readers appreciate your interest in flood phenomena as well as in other major and vital problems with which we are confronted. While arranging to increase facilities for observing hydrologic data, we should not overlook the lessons from past experience.

C. S. JARVIS
Consulting Hydraulic Engineer
Washington, D. C., April 22, 1938

RIVER DISCHARGES, GILA RIVER BASIN
(Daily Mean)

River and Station	Drainage Area	Years of Record			Discharge in c.f.s.		Discharge in c.s.m.			Myers Rating
	Sq. Mi.	Av.	Max.	Final	Av.	Max.	Av.	Max.	Date of Max.	%
Gila, near Solomonsville, Ariz.	7,900	19	22	1936	488	100,000	.062	12.7	Jan. 19, 1916	11.3
Gila, Coolidge Dam, Ariz.	12,880	42	42	1936	480	130,000	.037	10.1	Jan. 20, 1916	11.4
San Pedro, Charleston, Ariz.	1,480	7	26	1936	66	98,000	.045	66.3	Sept. 28, 1926	25.4
San Pedro, near Mammoth, Ariz.	3,850	5	10	1936	52	90,000	.014	23.4	Sept. 28, 1926	25.4
Sonoita Cr., near Patagonia, Ariz.	210	4	6	1936	10	20,000	.048	95.4	August, 1934	13.8
Cave Creek, near Phoenix, Ariz.	200	...	...	...	.....	25,000	...	125	August, 1921	17.7
Salt, near Roosevelt, Ariz.	4,310	29	23	1936	1,160	100,000	.270	23.2	Jan. 19, 1916	15.2
Verde, near Mc Dowell, Ariz.	6,230	32	39	1936	849	96,000	.136	15.4	Nov. 27, 1905	12.2

The 120,000 sec. ft. Verde River flood of March 4 as it flowed 100 ft. deep over Bartlett Dam construction operations. Although twice the record flood, even greater flows are possible. The reservoir spillway will have a 175,000 sec. ft. capacity.

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MAY 5, 1938

REASONED PROTEST against the WPA plan of conducting relief work has been made by the Wisconsin Construction Industry Conference; its statement, abstracted in our news pages, merits close attention. Though coming from representatives of the construction industry, the statement actually addresses the general citizen —unemployed as well as employed—for it points to the WPA's destructive effect on communities, on citizens, and on the relief workers themselves. In net effect the protest supports the growing belief that WPA methods are steadily tending to convert the temporary evil of depression unemployment into a chronic evil. If at first the construction industry is the chief sufferer, whose business is being destroyed and whose working forces are being thrown on relief by WPA invasion, yet in final effect everyone is hurt: the taxpayer through excessive costs, the worker through the illegitimate competition of relief labor, and the unemployed through being taken from his chosen calling and thrown into field construction. Protest is particularly in order just now, when new and greatly increased relief work appropriations are being considered by Congress.

Tunneling Achievement

HOLING THROUGH the 5,000-ft. Hudson river section of the north tube of Lincoln tunnel on May 2 marked another notable tunneling achievement. The shield that started from the New Jersey side only eight months ago averaged 29.6 ft. per working day, thereby showing that the phenomenal daily progress of 30 ft. maintained on the south tube was no accident of good luck. On the north tube the driving speed was at first curtailed to preclude disturbance of the south tunnel, now in use, but fear of such disturbance proved groundless. At the start about 50 per cent of the muck was admitted through the second shield but gradually this was reduced to 20 per cent, the same as for the previous tunnel, when no appreciable movement of the south tube developed. The belt conveyors and the mechanical bolt tighteners, first used on the south tube, worked even better on the second. Lincoln tunnel has written an interesting page in tunneling history.

Welding Not Discredited

IN THE DECADE OR SO after structural welding first was accepted as a promising means of steel fabrication no serious failure occurred to slow its rise in popularity. About a month ago, however, this record, unsurpassed by any other new process during its development period, was marred by the collapse of a welded bridge in Belgium. In view of the welded buildings, bridges, structures and large pieces of machinery that are carrying loads successfully in all parts of the world, it cannot be said that welding as such is discredited by the failure. From an account in this issue it appears that poor quality of work, which should have been detected by inspectors, was at the root of the difficulty. As with all failures, the duty of the engineering profession is clearly to determine the cause and to develop procedures to prevent a recurrence. The brittle character of the metal, even some distance from welds, needs explaining; the use of butt welds in tension is placed under a suspicion which needs to be removed if possible. Belgian engineers, who have many successful welded bridges to their credit, should be well qualified to lift the mystery from this unfortunate failure. American engineers will await their report with hope that bridge welding will not be placed under a cloud.

City Credit

SUBSTANTIAL GAINS should result from the Supreme Court decision last week upholding the amended Municipal Bankruptcy Act in a California irrigation district case. The court held that the amended act, by making federal action contingent on the consent of the state, removes the claim of interference with state powers that was the ground for invalidating the original act. Pointing out that the state itself is powerless to arrange for readjustment of municipal debts—since the federal constitution prohibits impairment of contracts by state legislation—the court declared that the state by its consent invited "the intervention of the bankruptcy power to save its agency which the state itself is powerless to rescue". Through this clear declaration of principle and law the Supreme Court has opened a way to clearing up many cases of financial chaos resulting from municipal debts impossible of payment. Its action, however, holds out a warning to cities and districts that they must guard their credit. Any community that invites bankruptcy and inevitable debt readjustment through extravagant financing is more certain to destroy its credit now than prior to the Supreme Court's decision. The

new situation created lays additional stress on wise and prudent financial management of cities as the only road to maintained credit.

Sober Second Thought

ACKNOWLEDGMENT OF UNFAIRNESS is implied in the rejection of bids received on the one-sided invitation to furnish cement that was issued by the Procurement Division some weeks ago. To remove this unfairness the Division is now trying to determine how much cement the government will require during the contract term—evidently with a view to issuing a call for bids that will be something more than a wild gamble. However belated, this action is a welcome recognition of the fact that when the government enters into business dealings it is subject to the same principles of fairness and mutuality as are private individuals. If fully considered in the drafting of the new call, these principles may suggest further changes. The original call for bids was written in the spirit of taking advantage of the other party. Unvarying experience teaches that a contract drawn in this spirit always fails, and the lesson should be heeded as carefully by the government as by individuals.

Public Housing Costs

SIGNING of the recent contract between the New York City Housing Authority and the United States Housing Authority for a $30,000,000 loan for two public housing projects provides opportunity for some interesting cost comparisons. They, in turn, raise some fundamental questions regarding our present public housing program. Can we afford it? And if so, is it a logical approach to the problem?

We already are committed to several hundred million dollars of expenditure. In New York City four existing housing projects provide homes for 4,579 families. Two of these (Hillside and Boulevard Gardens) are of limited-dividend type, i.e. privately built for limited profit but with benefit of a low-interest federal loan; and two (Williamsburgh and Harlem Houses) were built for the public, the funds being provided by a 45 per cent PWA grant and a 55 per cent loan to the New York Housing Authority. The capital costs (including land) of an apartment in Hillside and Boulevard Gardens were $5,000 and $4,200 respectively, in Williamsburgh and Harlem Houses $8,000 and $7,300. The new USHA housing for 5,194 families is estimated to cost $4,626 without land, or about $6,000 total. Though still above the costs of the limited-dividend projects, because of higher land prices, these figures are trending downward, and since the construction cost for the USHA housing is some 10 per cent under the maximum allowed this may be said to be low-cost housing as defined by the federal act.

If rents rather than capital costs are considered the new housing has never been equaled. Whereas the limited-dividend housing was built to rent for $11 per room per month and PWA housing for about $7, the USHA housing in New York City will cost the renter only $5.15 per room. It may be concluded that large-scale public housing has finally been achieved. But there has been too little discussion concerning the ultimate cost to the public of this program of fine objectives.

The present $30,000,000 worth of projects in New York City will be entitled to over a million dollars a year subsidy from the federal government. This will provide homes for 5,000 families, or one-sixtieth of the 300,000 families in the city that are said to lack decent living quarters. Is the nation prepared to contribute in due course the full $60,000,000 a year to New York City, plus proportionate amounts to the scores of other slum cities, whose needs are correspondingly great? And this subsidy cost is not the whole story, for there is the further possibility that the federal loans may not be repaid. Only a few weeks ago the 55 per cent loans to the existing PWA housing were, in effect, cancelled in order to assure low rents!

The answer to the question of ultimate cost of public housing needs to be carefully weighed by the whole country. In doing so it will be well to remember also that the housing now being provided is not for the lowest-income group—that needs it most—but for a selected group whose income is about five times the rents that a subsidy can make possible. And this raises the question whether the present approach to solution of the housing problem is a logical one.

The course of the approach to the problem may be briefed thus: First, we decide that the slums in which the lowest income group must live should be razed and decent housing provided for their inhabitants, but that private enterprise cannot provide the better housing and that public subsidies are necessary. Next, we plan and build so uneconomically that the resulting housing is too costly for the genuine poor, despite large operating subsidies. It is necessary to revise the program, and so slum residents are excluded and a population stratum well above the bottom is made the objective of the rehousing effort. Even under this revised program, if carried out fully, we are faced with a tremendous annual subsidy.

Is a program of such character logical and destined to succeed? The answer to this question, too, has been begged in the emotional discussions that have launched the nation on its public housing program.

PICTURES IN THE NEWS

ENR Staff Photo

THREE FINGERS of drinking water for Southern California, as it leaves the Colorado River Aqueduct intake pumping plant at Parker Reservoir for the 240-mile journey across the desert to Cajalco Reservoir from whose outlet tower (at the right) water will be distributed to Los Angeles and nearby cities.

Bureau of Reclamation Photo

PILOT KNOB WASTEWAY on the All-American Canal, whose completion this year will permit water (for tempering) to be turned into the first 20 miles of the canal at Imperial Dam on the Colorado River, and turned out again into the existing Imperial Canal at this point. Gates at right will divert water into wasteway.

YELLOW RIVER BRIDGE NEAR TSINANFU, LATER BLOWN UP BY RETREATING CHINESE TROOPS LAST NOVEMBER

Engineering in War-Torn China

O. J. TODD
Consulting Engineer, College of Chinese Studies, Peking

New construction has come to a stop and roads and railways are in war service, while river control works are neglected and bridges destroyed

From the heart of the great Chinese War area the author reports that engineering construction and development work there have come to a complete stop. Practically all American engineers have left and Mr. Todd also expects shortly to return to the United States. Destruction is extensive. The large Yellow River bridges were blown up in the military movements. The extensive river-protection works are neglected, and if abnormally high water occurs this summer disaster may overtake the Yangtze or the lower Yellow River Valley. — EDITOR

SINCE JULY of last year the engineering profession has found itself in a difficult position in China. The military engineer has been busy enough, as he always is in time of major hostilities, when he is compelled to do emergency duty and never allowed the time required to do his work by peace-time methods. Meantime the civil engineer is pinched out of his peace-time occupations for two reasons. First, funds for his work are curtailed in order to conserve all possible revenue for war equipment, and, second, his work often lies in regions through which armies are marching and he is prevented from pursuing his normal work.

So China finds her civil engineering work crippled and many of her permanent structures destroyed. The blowing up of the long spans of the lower Yellow River railway bridge near Tsinanfu in November meant the interruption of through traffic for three months. But the Japanese engineers have now put in a temporary wooden trestle bridge that permits trains to cross the river there. The original steelwork came from Germany 30 years ago, as German engineers and German capital built the northern half of the Tientsin-Pukow Ry., and this bridge was its largest structure. Its original cost was about $3,000,000 (U.S. money). Unless the piers have been greatly damaged by the explosions that wrecked the superstructure the bridge can be put back in its former condition for less than $1,000,000. Other bridges on this railway have been destroyed during the fighting, but they are of much less consequence.

Fighting now in progress close to the Yellow River along the Peking-Hankow Ry. has caused the Chinese to destroy a part of the two-mile railway bridge over that river. This bridge is made up of many short spans, so that the destruction of a number of them will not be a great monetary loss. Estimates for the construction of a new bridge at this crossing of the Yellow River are from about $2,000,000 to $4,000,000. The present bridge is 30 years old and should be replaced by a new one.

The fine bridge across the Chien Tang River near Hangchow, south of Shanghai, recently completed at a cost of $3,000,000, has also been partly destroyed during recent months of fighting.

The losses to such utilities as the Nanking waterworks and lighting plant have not been reported as very great; they were damaged by bombing from the air. The heaviest losses to engineering structures in municipalities came in Shanghai, where artillery fire and bombing caused heavy losses to industrial plants, warehouses along the Whangpoo River, etc. The rebuilding of this part of Shanghai will likely take ten years or more, at costs yet to be estimated. The blowing up of Japanese mills in Tsingtao by Chinese armed forces

shortly before their retreat from eastern Shantung caused heavy losses to that city industrially. As the war continues these losses to public utilities, mills, business houses and residences will mount and the total value of such losses will be difficult to compute until after hostilities have come to an end.

But the civil engineers, who have had important functions and studies to perform, are worried over the loss of an opportunity to pursue their duties. What about river conservancy, for example?

New flood dangers developing

Early in the war funds were so cut off that the North China River Commission had to close its doors. Its staff has been scattered to the four winds. A very similar condition seems to exist with regard to the Yellow River Commission and the Yangtze River Commission. The whole lower Yellow River country is either in the war zone or has fallen to the control of Japanese forces. Over long stretches the Japanese hold one bank while the Chinese hold the other and there is constant fighting in progress across this river. So engineers cannot for the time function effectively on Yellow River control. If this situation continues for many months it may have disastrous consequences.

Similarly the Yangtze River is controlled from Wuhu to the sea by Japanese forces, while west of Wuhu the river is under Chinese control. Local dike upkeep may be handled by the armies in control of their sectors if they see fit to do so, but no connected plan will be in force in 1938. There are no funds in China today for river maintenance work or for employing suitable river engineers, and this type of work must lag during the period of hostilities.

In case of severe floods during the coming summer—the time of extreme high water on the Yangtze and the Yellow River—there will be losses greater than in normal times, for the protective work will not be well organized, nor will it be possible for any one body to handle either of these rivers as an entire unit. On neither river is there a high factor of safety to take care of danger from overtopping of dikes, and this increases the danger for 1938. Local organizations will have to take care of upkeep necessary for protection from moderate flood flows, though the movement of large blocks of population fleeing from the war zone has upset the ordinary county governments and will weaken this force for defence against natural calamities.

The roads go military

As regards road construction, it goes forward in this war period only where it aids the movements of troops and war supplies. Both armies must keep the roads they need in fairly good repair.

Shortly after the war started in North China engineers were recruited from some of the government river commissions to lay out and supervise the construction of a paved road from the Shihchiachwang across country to Tsangchow (both places in Hopei Province) to connect the Peking-Hankow Ry. with the Tientsin-Pukow Ry. Heavy rains and floods as well as delays in getting funds held up the construction. Just as the eastern end was completed the Japanese troops occupied Tsangchow, and when the western end was done they took Shihchiachwang.

Thus the young engineers had an early baptism of fire, and most of them were wounded. Three of their number were killed by machine gun fire, being surprised by the rapid advance of the Japanese. One disappeared entirely and nothing has been heard of him since.

In West China reports indicate that a large-scale roadbuilding project will soon have Chengtu in Szechuan connected with points in the extreme northwest of Kansu Province. This will permit the hauling in of military supplies from the region near Tashkent, north of Sinkiang. Other road extensions are going forward in the provinces of Szechuan, Yunnan and Kweichow so as to link up the railroad at Yunnanfu with points on navigable rivers tributary to the Yangtze. Many Chinese engineers thrown out of employment by the war near the coast are now employed on these projects in West China.

With respect to railways, the war has cut off construction supplies, so that the intended extension of the Lung-Hai Ry. to the west of Paoki, Shensi, 90 mi. west of Sianfu, is not now practicable. Grading is costly in this region of rough topography, and it is not likely that the Chinese Government will expend large amounts for continuing the construction of this line until a foreign loan is possible.

Other railway extensions in the south to permit supplies to enter China from French Indo-China are more practicable, and Chinese railway engineers will likely be engaged during hostilities in pushing the extension of this railway line. That, as well as the maintenance of the newly completed Canton-Hankow Ry., so that Hankow may have rail connection with a seaport in the south, is occupying the attention of several of China's best railway engineers.

As already mentioned, many of the Chinese engineers have left the seacoast for western China. They have seen their former work stopped and are on the move. Those still on railway work are busy enough, but the mileage of railway in the hands of the Chinese Government is gradually becoming more limited. At present it includes the Canton-Hankow line, the Peking-Hankow line from the Yellow River to Hankow, the Tientsin-Pukow line fom the Hwai River north to Lincheng in Shantung, and the Lung-Hai line from Hsuchow to western Shensi, plus 200 mi. of line radiating out of Nanchang, Kiangsi, aside from the French owned line in southern Yunnan coming up from Indo-China.

Reconstruction

In the areas occupied by the Japanese a small amount of emergency reconstruction is taking place, such as the new earth roads around Peking. For the areas north of the Yellow River large-scale industrial developments are being planned; but due to the heavy drain which the war is making on Japan's resources and the uncertainty of the future this development program seems likely to move with no great speed until the outlook becomes brighter.

Permanent reconstruction on a scale contemplated before hostilities began will not be undertaken until Japan and China get to a better understanding. Neither party to this conflict can afford to go at a broad program of construction of a civil nature at this juncture of affairs. Engineers will follow military work for the moment if they are to remain occupied in large numbers in their own profession here in China.

Bigger Than Boulder

Final plans for Shasta Dam reveal it as containing 70 per cent more concrete than Boulder Dam and as having a height greater than Grand Coulee Dam.

THE OPENING OF BIDS, June 1, for Shasta Dam on the upper Sacramento River in California will usher in another dam building job that is destined to become world famous. Boulder Dam with its 3,250,000 cu.yd. of concrete is virtually finished. Grand Coulee Dam, with an ultimate 9,740,000 cu.yd., is again the scene of intense activity. In between these structures, which know no peer in the dam world, will be Shasta Dam with a concrete volume of 5,400,000 cu.yd. Its extreme height of 560 ft., from lowest foundation to top of roadway, although considerably less than Boulder, is 10 ft. greater than Grand Coulee; and when measured from tail-water elevation to full reservoir surface, it is 153.5 ft. greater than Grand Coulee, a height, it is believed, which probably approaches the limit to which gravity-section dams can safely be built without greatly increasing their thickness to resist the shear stresses.

Shasta Dam will be located 14 mi. north of Redding and 5 mi. below the mouth of the Pit River. It will be of gravity type, with a straight, center spillway 375 ft. long and slightly curved (2500-ft. radius) abutments, a plan chosen to fit the structure to the optimum foundation conditions of the site. The abutments will rise on a 3:1 slope from a streambed width of 150 ft., and at the left end will terminate in a rolled earth-and-rock fill enclosing a concrete core wall; this fill-and-core wall design was chosen for economy since its foundations are much shallower than would be required for a continuation of the gravity section at the left abutment where the depth to sound rock is very great. The total length at the top of the dam is about 3,500 ft., of which the gravity section accounts for 2,860 ft., and the width is 37 ft., accommodating a 30-ft. roadway and two sidewalks. The dam will provide a gross storage capacity of 4,500,000 acre-ft. of which 500,000 acre-ft. will be dead storage to maintain minimum power head while the top 500,000 acre-ft. is to be used jointly for flood control, irrigation or other purposes.

Powerhouse plans

The powerhouse, which is a part of the project, will be a reinforced concrete structure, 76x446 ft. in plan, located just below the dam on the west bank. The initial power installation will consist of four vertical-shaft 70,000-kw., 13,800-v. generators, each connected to a 100,000-hp. turbine operated under heads from 242 to 479 ft. Provision is made for the addition of a future unit, bringing the ultimate plant capacity to 350,000 kw. The 14-ft. diameter penstocks, which will pass through the dam at the right abutment 262 ft. from the top, have an average length of 900 ft. In addition there will be a 4-ft. diameter penstock that will feed two 4,250-hp. turbines connected to 3,000-kw. generators to supply plant light and power.

Tractor-type closure gates operated by manually-controlled hydraulic cylinders will be installed at the upper end of the 14-ft. diameter penstocks.

The spillway will be topped by three 110x28-ft. drum gates separated by 15-ft. piers containing the operating mechanism and supporting a structural steel girder bridge, faced with concrete, which will connect the roadways on the abutments. The spillway discharge capacity is 187,000 sec.-ft. To regulate outflow through the dam during normal operation, thirteen 102-in. diameter steel-lined conduits will be provided extending through the spillway face at three levels 100 ft. apart; seven conduits in the top tier and three each in the low tiers. The circular section of these conduits is constricted at the outlet ends to eliminate negative pressure and reduce the danger of cavitation. Discharge through the outlets will be

Fig. 1. Where Shasta Dam will rise to impound floodwaters of the Sacramento River. During the construction period, the railroad will pass under the hill at right which will form one abutment.

controlled by ring-seal gates installed in gate chambers near the upstream face of the dam; the gates are to be operated in tandem for the lower tiers and singly for the top tier. For emergency or maintenance work a bulkhead gate, to be lowered from a barge, will be provided. The maximum discharge through the 13 outlets is 57,000 sec.-ft. with a full reservoir and 10,000 sec.-ft. under extreme reservoir drawdown.

For close regulation of flow, two 86-in. diameter conduits, controlled by 60-in. needle valves in the powerhouse, will be used. These conduits pass through the dam about 47 ft. below the lowest tier of main outlet pipes. Ring-seal gates in chambers near the upstream face of the dam are provided for emergency and maintenance use. The spillway terminates in an apron 260 ft. long, warped near the end to produce a hydraulic jump to dissipate the energy of the water falling from the unprecedented height of 487.5 ft.

The embankment section of the dam will consist of a moistened and rolled fill of clay, sand and gravel and rock fills of increasing thickness from crest to foundation on the upstream and downstream slopes. A vertical concrete corewall will extend through the central portion of the earthfill and will contain a grouting and drainage gallery in its base.

An idea of the size of Shasta Dam may be gained from some of the typical quantities of materials required as listed in the bid schedule. In addition to the 5,400,000 cu.yd. of mass concrete in the main dam, 250,000 cu.yd. of reinforced concrete will be required for appurtenant works. Reinforcing steel totals 13,000 tons. For the foundations of the concrete dam, 1,500,000 cu.yd. of rock and 660,000 cu.yd. of earth must be excavated. An additional 1,000,000 cu.yd. will have to be taken out in connection with the construction of the powerhouse, tunnels, etc. The fill embankment will require 1,500,000 cu.yd. of earth and rock. Some 300,000 ft. of grout holes must be drilled, and 1,500,000 cu.ft. of pressure grouting is estimated to be required. Tubing for concrete cooling and grouting totals 3,000 tons.

It is estimated that a construction period of 5 years will be required to translate these quantities into the finished structures. Still another measure of size is the fact that 12,000 sheets of drawings are estimated to be required.

Notable features

A number of novel features characterize the Shasta Dam design, some of which are still under study. For example, the unusually high overflow of 487.5 ft. occurs in combination with unusually shallow tailwater. This makes necessary recourse to a hydraulic jump instead of the buckets used at Grand Coulee, and no precedent exists for designing the proper shape or length of apron. Consequently field tests are to be

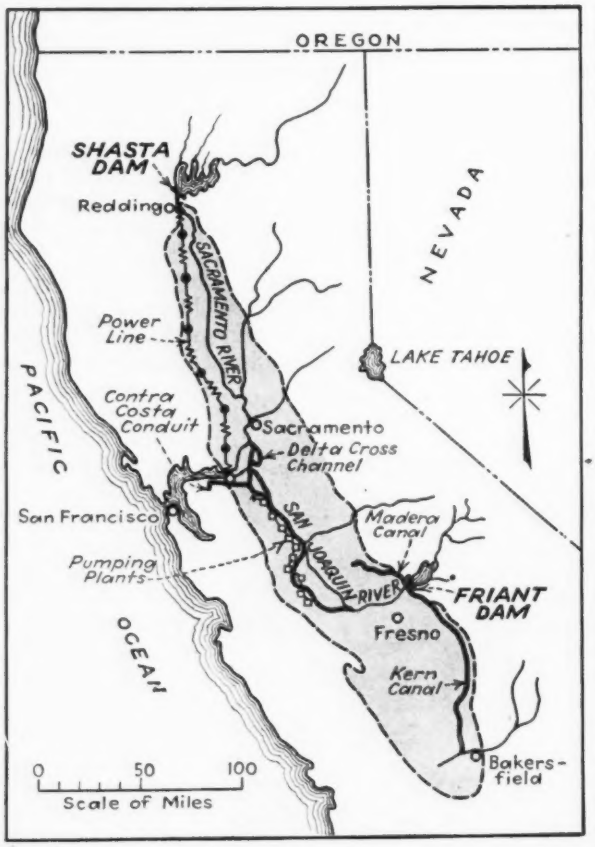

Fig. 2. Location of Shasta Dam relative to other elements in the $170,000,000 Central Valley Project. Water from Shasta storage will be used to resist salt water incursion in Delta region and to replenish groundwater in San Joaquin Valley.

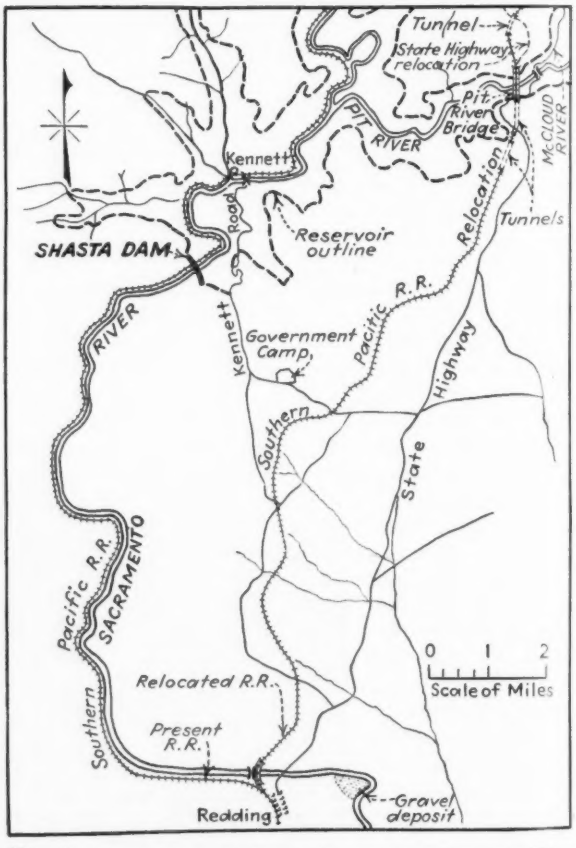

Fig. 3. Shasta Dam site is on the upper Sacramento River and the reservoir will extend up several tributaries, notably the Pit River. Map shows also the 30-mi. relocation of the S.P.R.R. required by construction of the dam.

made on the Kittitas division of the Yakima irrigation project in Washington where a 375-ft. drop is available; these tests will be supplemented by laboratory model studies. The 102-in. diameter outlets are also novel, being curved in a vertical plane so as to discharge tangent to the dam face, and being reduced in diameter in the last 9 ft. to eliminate a negative pressure disclosed in model studies.

Perhaps the most notable characteristic of the dam will relate to the method of fitting it to its foundations. Already, extensive investigation work, involving tunnels and drill holes, has been completed. Despite the use of the earthfill-and-core-wall design at the left end, over 3,000,000 cu.yd. of excavation will be necessary. Studies are still under way to determine if it is possible to eliminate some of this excavation by washing and grouting seams in the intermediate rock, which is on top of the sound rock but beneath the disintegrated overburden; this intermediate rock could then be utilized as dam foundation.

Place in Central Valley

Shasta Dam is the key unit in the great Central Valley irrigation and flood control project, for in its reservoir will be stored the water that is to be used to accomplish the multiplicity of purposes encompassed in the plan. It will be recalled (*ENR*, Aug. 26, 1937, p. 344), that the water from abundant seasonal rainfall in the upper Sacramento Valley is badly needed to replenish groundwater in the San Joaquin Valley 500 mi. to the south, and to check salt water incursion from San Francisco Bay into the delta region of the San Joaquin and Sacramento Rivers. As outlined in that article the necessary works to achieve these ends are in three parts or divisions: (1) Kennett division, at the north, which includes the Shasta storage dam, its power plant and a transmission line running 200 mi. south to the delta region; (2) the Delta division, which includes a pumping system to get Shasta water into the San Joaquin River, and in addition the Contra Costa Canal (already under construction) which will convey some of the water to a new reservoir in the upper San Francisco Bay area; (3) the Friant division, including Friant Dam on the upper San Joaquin, supplemented by the Madera Canal leading north from Friant and the Kern Canal leading south. In all, the project, involving the two dams, 350 mi. of canals, the Shasta power plant and transmission lines and supplemental works will cost about $170,000,000.

Shasta Dam foundations

For over a year extensive investigation of the Shasta Dam site has been under way. Over a mile of tunnels and adits, two miles of diamond drill holes, 180 ft. of shafts and 190 ft. of 36-in. calyx drill holes have been driven. The work has revealed that the rock is andesitic in character, made up of metamorphosed lavas and tuffs. Below weathered and shattered material the rock is greenish-gray in color, of dense and uniform texture. Solid rock is exposed on both banks near the bottom of the canyon; higher up the sides shattered rock goes to depths as great as 100 ft.

If all the shattered material is removed, excavating will amount to some 3,000,000 cu.yd. However, fairly sound rock, though somewhat shattered, is found below weathered material at the surface. As stated, investigations are being made to determine whether this material can be rendered adequate by washing the seams and grouting, thus greatly reducing necessary excavation. The procedure would be to drill holes about 30 ft. deep on 5 to 20 ft. centers over part of the foundation area, wash clay from the seams between the holes and then grout.

Regardless of the decision with respect to washing and grouting prior to construction, a line of 1¾-in. holes 10 ft. apart and 75 ft. deep along the upstream edge of the dam will be grouted at 400 lb. per sq.in. pressure after the dam concrete has been poured to a height of 50 ft. Then after the dam is completed another line of 1¾-in. holes on 5-ft. centers will be put down 150 ft. through the floor of a drainage gallery near the upstream base of the dam and grouted at 1,000 lb. per sq.in. in pressure to give a complete grout screen. From this same gallery 3-in. diameter drainage holes, 50 ft. deep and on 5-ft. centers, will be drilled after grouting is complete.

Design considerations

The plan and typical sections of the dam are shown in the accompanying illustrations. In the design, stress and stability studies followed usual procedure for gravity dams, ignoring any arch effect which may exist by virtue of the curved abutments. Earthquake accelerations of 0.1 g., either vertical or horizontal, were included among the loads. Finally, the uplift pressure on the base was assumed to vary as a straight line from full reservoir pressure at the upstream face to zero at the downstream face and to act over two-thirds of the horizontal area of the base.

Under the loads assumed, low tension stresses will exist at the downstream face when earthquake accelerations occur during extreme reservoir drawdown. Otherwise compressive stresses exist at both faces, those on the upstream face exceeding 50 per cent of the water pressure

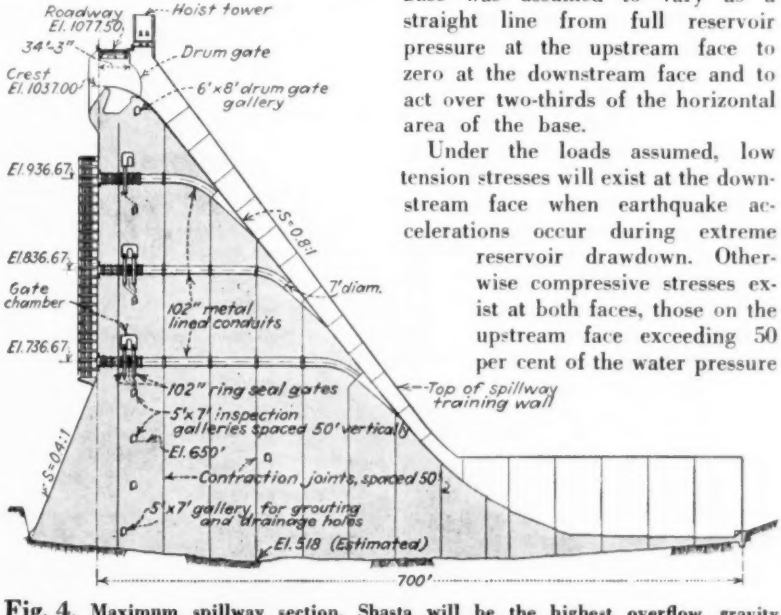

Fig. 4. Maximum spillway section. Shasta will be the highest overflow gravity dam yet built and its concrete yardage will be second only to that of Grand Coulee.

at all times. Maximum compressive stresses occur at the downstream face under full reservoir and equal 539 lb. per sq.in. without and 744 lb. per sq.in. with earthquake loads included.

The maximum sliding factor is 0.61 without and 0.90 with earthquake loads, while the minimum shear-friction factor (ratio of shear resistance to maximum shear force) is 6.6 for full reservoir without earthquake loads and 4.6 when earthquake loads are included.

Construction plan

The concrete dam will be built in 50x50-ft. columns, placing concrete in 5-ft. lifts. The transverse contraction joints between the columns will be continuous from upstream to downstream face while the longitudinal joints will be staggered. Keys on all the joints assure that no column or block will slide along an adjacent one. Systems of grout pipes will be installed in the mass concrete with outlets into the contraction joints which will be pressure grouted after the mass concrete loses its heat.

Low-heat cement will probably be used but, in spite of this, some 50 to 90 deg. of heat will have to be artificially removed from the concrete so that volume changes will be completed in time to permit grouting the joints as construction proceeds. The cooling system will consist of 1-in. pipes on 5-ft. 9-in. centers placed on top of each 5-ft. lift and concreted in. The river water is cold enough so that artificial refrigeration, such as was used on Boulder Dam, will probably not be necessary. The dam will be divided into 16 cooling zones from 2 to 6 blocks wide and extending for the full thickness of the dam. In each of these zones a 3½-ft. diameter cooling shaft, to accommodate the header pipes from the cooling system, will extend down to longitudinal galleries at various elevations near the upstream face of the dam. It is from these galleries also that contraction joint grouting operations will be carried on.

Materials are to be brought in over the S.P.R.R. to a warehouse about a mile below the dam. Near here the penstock fabricating plant will also be located.

A vital operation, to which the construction schedule must be keyed,

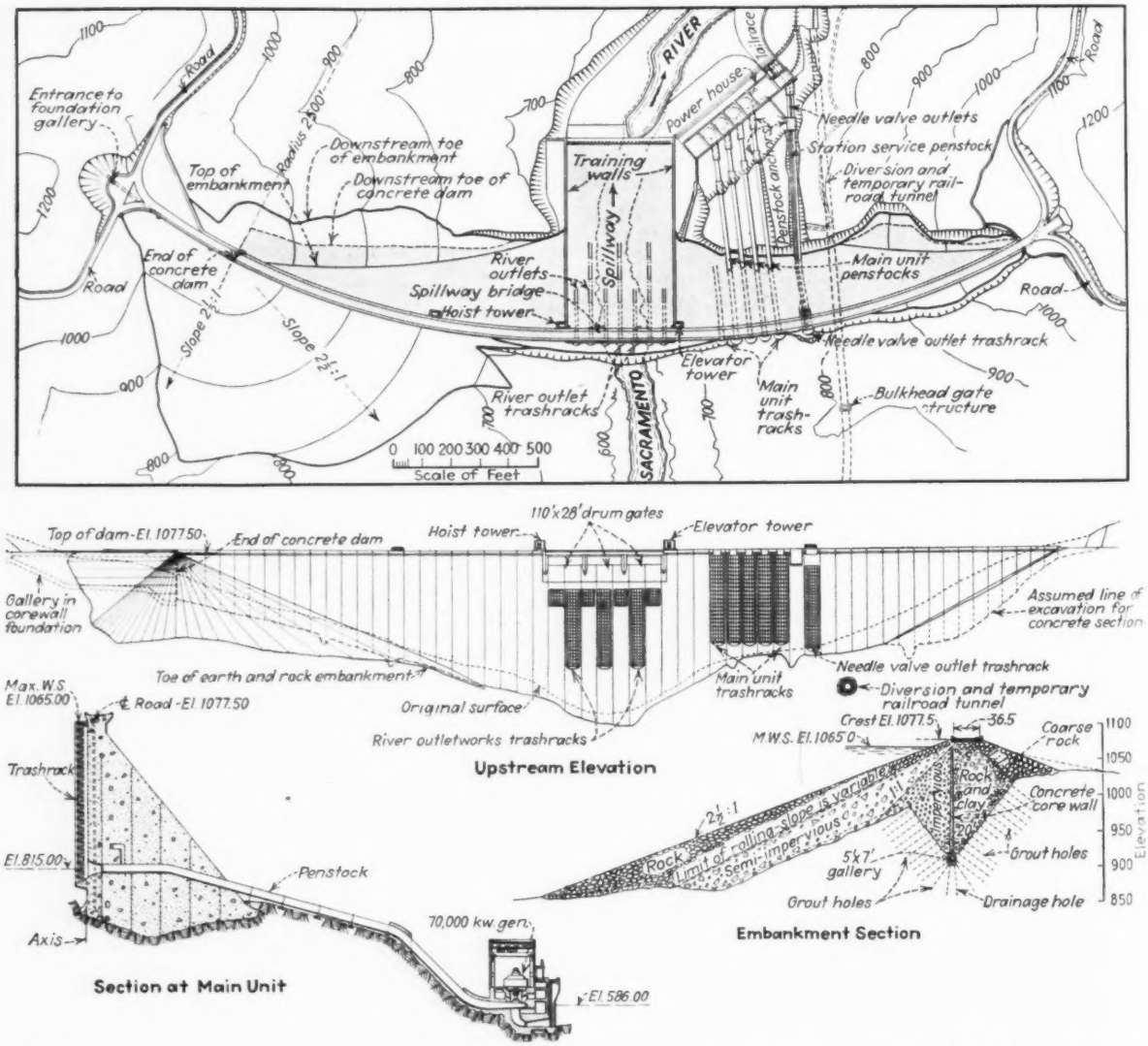

Fig. 5. Plan and sections of dam and powerhouse. Earth embankment section at left abutment adopted to save excavation and additional concrete required if gravity section were extended entirely across the valley.

is the relocation of the main line of the S.P.R.R. which runs through the dam site near the bottom of the canyon. It is required to build a 30-mi. relocation around the reservoir site, and originally it had been planned to finish this work before starting actual construction on the dam. An interesting substitute plan has been worked out for detouring the railroad through a tunnel under the west abutment of the dam thus permitting construction of the lower portion of the dam to proceed immediately and simultaneously with the building of the new permanent railroad line. By this plan, about 30 months' time is saved in starting work on Shasta Dam.

Contract for the tunnel, which is to have a 25-ft. horseshoe section, was let in April. The tunnel will be 1821 ft. long and deep enough in the rock not to interfere with dam foundations. It will be used for river diversion after the railroad vacates it.

Shasta Dam and the other Central Valley structures are being built by the Bureau of Reclamation, John C. Page, commissioner; R. F. Walter, chief engineer; S. O. Harper, assistant chief engineer, and J. L. Savage, chief designing engineer. Walker R. Young is construction engineer for the Central Valley project with offices at Sacramento.

Over 1,000 Ft. of Continuity

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New eight-span continuous girder bridge replacing the venerable Chain Bridge at Washington, D. C., is one of the longest of its type in the country

THE NEW Potomac River bridge now being built at the site of the early Chain Bridge at Washington, D. C., contains one of the longest series of continuous girder spans in this country. Replacing an eight-span through truss iron bridge erected in 1874, the new bridge contains eight spans also and is 1,351 ft. long between abutments. It utilizes the old stone pier and abutments for foundations, the only change being an increase in height to give greater flood clearance.

The history of bridges at this point is long and varied, dating from an act passed by the General Assembly of the State of Maryland in 1791 to authorize the incorporation of the Georgetown Bridge Co. Two wooden bridges built by this company collapsed one after the other, due in the first instance to natural decay and in the second to a freshet. By 1808, however, a new crossing of the Potomac had been completed, of 128½ ft. span and "supported solely by iron chains extended across the river, thrown over piers erected on the old abutments, about 20 feet high," according to an early account. The design of this "chain bridge," after which all subsequent bridges at the site have been named, followed in general the principles used about that time by Judge Finley and was reputed to be amply strong. But in 1810 it also was carried away by a freshet, leaving only the anchored chains and old abutments for the support of subsequent bridges.

The piers and abutment on the District end of the present longer crossing were built in 1812, from rock taken from the river bed at this point, and were founded upon the solid rock. Apparently one bridge followed another at this important location, and that one in existence during the Civil War was for a time the only connection which the government had for the passage of troops between the District of Columbia and the state of Virginia. Finally, with the opening of the eight-span iron truss bridge in 1874 the District of Columbia acquired full ownership of the crossing; and no real alterations to this latest bridge were required until the Virginia abutment was replaced in concrete in 1927.

The strength of the eight-span iron bridge and the facilities which it carried were already becoming inadequate when the spring flood of 1936 threatened the structure. High water in the Potomac River reached so close to the bottom chord on the Virginia end that a tree jammed against the bridge. Accordingly, steps were taken by the District of Columbia to provide more ample facilities and higher clearances in a new bridge at the site; and their consulting engineers prepared the finished design under construction.

This new bridge employs all of the existing piers, but requires that they be built up to provide higher clearances, and at the same time give an agreeable vertical curve to the roadway profile across the river. Since deck girders are used the roadway elevations are raised substantially, and extensive additions are required for the two abutments, amounting on the Virginia end to an 11 ft. increase in abutment height. Additions to the pier tops are laid up of stone taken from the bed of the river at this point, to match in appearance the sound masonry of the existing piers. It was the stable construction of these existing stone piers which permitted the use of continuous girders in the new design and thus made possible the pleasing appearance resulting from shallow girder depths between piers and low flat bottom-flange curves in spans.

In determining the arrangement of the continuous spans, the varying span lengths (Fig. 2) across the river prevented the use of any symmetrical system. The three expansion links, which act in the manner of hinges as far as the continuous girders are concerned, were therefore placed near natural points of contraflexure, so that the whole bridge is in effect continuous under dead

Fig. 1. New Potomac River Bridge on site of old Chain Bridge at Washington, D. C.

load. Or, from another viewpoint, there are two fully continuous spans on the Virginia side connected by a span with a single hinge to three fully continuous spans on the District of Columbia side, to create an almost fully continuous structure of 1,020 ft. 10 in. total length; while two semi-suspended spans attached to the ends of cantilever projections from this structure complete the distance to the abutments.

The improved facilities provided are shown by the cross-section, Fig. 2. A 30-ft., three-lane roadway replaces the previous two lanes. Two new 20-in. diameter water mains, with provision for two additional 20-in. mains, replace the two 8-in. mains carried by the iron truss bridge; the new mains are hung by U bolts from the bottom flanges of the floorbeams, as near the girders as possible to reduce floor-beam bending moments. The roadway is a 7-in. reinforced concrete slab, and two 5-ft. sidewalks are cantilevered outside the girders. Floorbeams and stringers are of rolled wide-flange shapes, and the stringers are spliced to obtain continuity in them for the full length of each girder. Lateral bracing of large tees cut from rolled beams is provided in the plane of the bottom flange of floorbeams.

The bridge was designed for H20 live loading, and all of the girders are of silicon steel. Calculations of dead and of maximum live and impact moments throughout were made for the full six spans of continuous girder, including the span with the hinge, by means of the Hardy Cross method of distributing fixed-end moments, after calculations of stiffness and carry-over factors for the various spans had first been made. The summations for stiffness and carry-over factor were made by dividing each girder span into 16 segments, and these factors within span 3-4 were of course markedly different from those in the other spans because of the presence of the hinge.

The hinge points were all reasonably close to the natural points of contraflexure, but maximum design moments occurred at piers 7 and 1, respectively, as a result of the cantilever moments induced by the suspended end spans. The total design moment at pier 7 was 19,165 ft.-kips, and at pier 1 it was 16,912 ft.-kips. The silicon steel girder section used over pier 7 consists of a 142½ x ⅝-in. web, 4 8 x 8 x ¾-in. angles and one 20 x ½-in. and three 20 x ⅝-in. covers on each flange. The girder depth back to back of angles is 11 ft., 11 1/16-in. over each main pier, 10 ft., ⅛-in. at each abutment, and 8 ft., ½-in. at the center of each span.

Precise continuity of the girders was obtained geometrically by assembling in the shop with the girders blocked up to their correct no-load camber positions, keeping two full spans assembled in line, in which situation rivet holes in the field girder splices were drilled from the solid. The final dimensions of the girders as thus laid down in the shop were used to set the pier bearings in the field.

Links and bearings

Interesting details of the design are at the expansion links between girders and in the pier shoes. The hinge points are so situated as to create only tension in the connecting links, and these links, shown in Fig. 2, each consist of two vertical 15 x 1¾-in. hanger plates of carbon steel, with bronze bushings bearing on 7-in. pins. Roadway expansion at these points is obtained by using toothed dams.

Where rollers are used on the pier tops, the expansion shoes are specially designed to prevent locking by corrosion. This is accomplished by using a special corrosion resisting steel in the rollers and in special 1½-in thick plates on which they roll. The composition of the metal in the rollers follows U. S. Navy specification 46-7-18B, grade 3A; and in the rolled plates, U. S. Navy specification 47-7-20A, grade 3. All steelwork is painted with materials of the pigmented varnish type.

Actual work on the reconstruction was begun in July, 1937, by the Tuller Construction Co., Red Bank,

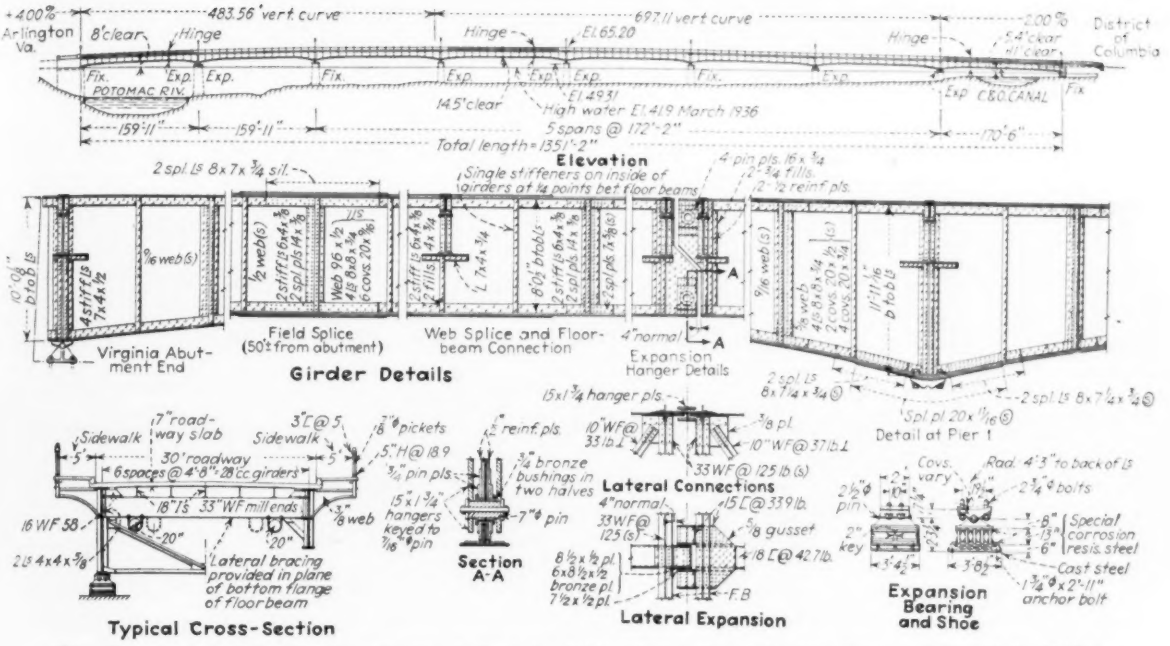

Fig. 2. Structural details of continuous deck girder bridge that replaces the iron trusses of the Chain Bridge.

N. J., contractor for the entire work. Subcontractor for fabrication and erection of the principal steel is the Bethlehem Steel Co. Work began by dismantling all of the old steel truss spans except the end span on the Virginia side across the Potomac River, and building up the masonry work as required. The single truss span across the Potomac channel was left in place temporarily because of the necessity of maintaining the water service throughout the reconstruction. Whereas the pipes could readily be kept in service beyond this span, a 35-ft. height over the Potomac channel had to be maintained; after the new girders had been erected on either side of it, the pipes were transferred to this support and the truss span removed.

Erection of the new girder spans progressed from the District end westward. Using a guy derrick with 80-ft. boom on the District shore to begin erection and place the first sections of girders as well as serve for unloading, a traveller with 90-ft. boom thereafter placed the girders in 86-ft. lengths, with one falsework bent usually being used to provide intermediate support in each span between the piers. To erect the girders across the Potomac River, work was carried on from the Virginia shore with the guy derrick, and from the second span with the traveller.

The reconstruction work is being carried out for the government of the District of Columbia, Engineer Department, Colonel Dan I. Sultan, engineer commissioner, under the supervision of Captain H. C. Whitehurst, director of highways of the District, and C. R. Whyte, engineer of bridges, following plans prepared by Modjeski and Masters, formerly Modjeski, Masters and Case, who made the design as consultants.

Structural Steel Test

THREE LINES of investigation in structural steel work reported in recent bulletins of the Engineering Experiment Station, University of Illinois, include the strength of columns and of hemispherical shells, and the effects of corrosion on test specimens subjected to torsional stresses. Column tests (Bulletin 292) indicate that in cylindrical shells with welded butt joints the wrinkling stress (ultimate load divided by area of transverse section) for plates ¼-in. or more in thickness will be approximately equal to the yield point of the material if this is 33,000 lb. or less and if t/r is 0.015 or more. Diaphragms do not appear to increase the stress of thin cylindrical shells loaded as columns. Design formulas for the more conventional types of columns appear to be applicable to these butt-weld shells.

In tests of laced-channel struts, light lacing was effective in making the two channels act as a unit, and the unit stress developed was 84 per cent of the yield point of the metal. On angle struts, the load carrying capacity varied from 74 to 93 per cent of the yield point. Light lacing connecting the edges of the outstanding legs did not increase the strength of angles 8x8x½-in. Failure was by buckling over the entire length rather than by local buckling of one leg. Tests on the combined effect of corrosion and stress concentration at holes and fillets in specimens subjected to reversed torsional stresses (Bulletin 293) indicated that the corrosive effect of water decreased the torsional fatigue strength.

In spherical shells of steel plate, as used for storing gases under pressure, the walls are subjected to a tension having the same intensity in all directions in a plane. To determine whether a plate under such conditions can resist the same intensity of stress as a plate subjected to stress in one direction only, tests were made on thin hemispherical shells of structural steel and aluminum alloy (Bulletin 295). It appears that a thin spherical shell of ductile material subjected to internal pressure will be safe if designed on the basis that the allowable unit stress equals that of the material under tension.

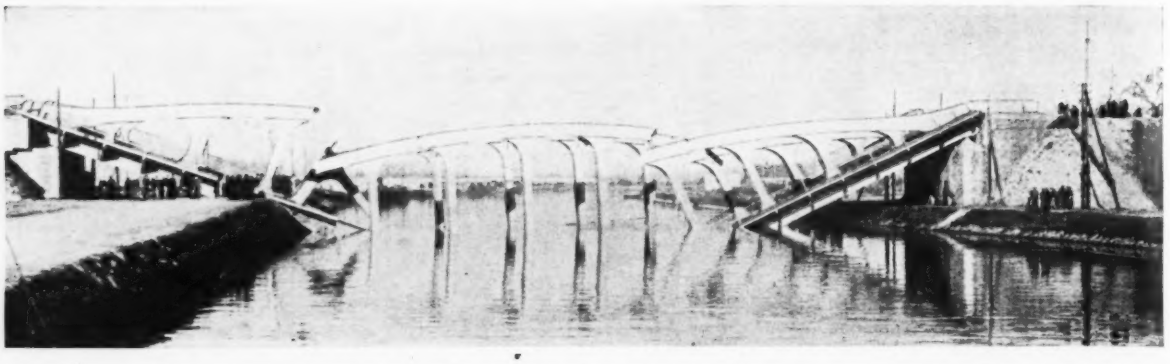

FIG. 1. WELDED BRIDGE WHICH COLLAPSED WHEN LOWER CHORD AT LEFT QUARTER POINT OF SPAN FAILED

Welded Bridge Failure in Belgium

Examination of wreckage of 245-ft. span Vierendeel truss reveals exceptional brittleness of both weld and parent metal

FULL EVIDENCE of the cause of the collapse, March 14, of an all-welded Vierendeel truss bridge of 245-ft. span near Hasselt, Belgium, still awaits the official report of the governmental investigators but enough is known of the accident to venture the assumption that the origin of the failure was in or near a bottom chord field splice at about the quarter-point of the span. These field splices were of direct butt type, without reinforcing plates.

Brittle metal found

According to the Belgian correspondent of *Engineering News-Record*, prevailing opinion holds that the principal cause of the accident was poor welding. Furthermore, it is stated that the breaks in the bridge members indicate an extraordinary brittleness of both weld and parent metal. Apparently the welding procedure used caused a radical structural change in the base metal or set up excessive residual stresses in the weld metal or both. Another possibility, suggested by the character of the break in the top chord (Fig. 4), which is a considerable distance from the field splice, is that the steel, as rolled, lacked ductility. On the other hand, the steel was specified as mild carbon, with an ultimate tensile strength of 55,000 to 60,000 lb. per sq. in. and an elongation of 20 per cent, which, if furnished according to specification, could hardly be termed brittle.

The Hasselt Bridge had been in service about a year, having been accepted by the authorities after undergoing successfully the specified live load tests on January 19, 1937. It was one of about fifty welded bridges of the Vierendeel type built during the last six years, mostly over the new Albert Canal, by the bridge and highway department of the Belgian national government. The first of these bridges were shop welded and field riveted, but the more recent structures were welded in both shop and field. (See *ENR*, July 25, 1935, p. 116). The span of the Hasselt bridge was the longest yet built.

According to an article in the September, 1936 issue of *L'Ossature Metallique*, Belgian magazine, from which the accompanying drawing showing the makeup of the members is taken, the Hasselt bridge had a 31-ft. roadway, accommodating both highway vehicles and an electric railway, and two sidewalks cantilevered outside of the trusses. All truss members were made up of double I-sections as shown. Rolled sections were used in the verticals, but the chords were built up entirely of plates. The trusses were 33½-ft. deep at the center of the span and contained 12 rigid frame panels without diagonals. Chord splices occurred in panels 2, 4, 7, 9 and 11. The chords came from the shop with the curved-gusset stubs of the vertical members of the truss attached so that two field joints were required in erecting these verticals. Stubs of floorbeams and of the top portal wind bracing were also welded to the chords in the shop.

Collapse was gradual

In the dispatches received from Belgium, it is stated that the collapse occurred shortly after 8 a.m. Eyewitnesses standing on the towpath of the canal heard a noise like a gun shot and saw a crack opening in the lower chord between the third and fourth verticals. The floorbeam between these two verticals was seen to sag immediately and, six minutes later, the bridge broke and fell in three pieces into the canal. Traffic and pedestrians on the bridge, warned by the noise of the first break, were able to get off safely.

Investigation showed that after the failure of the bottom chord, the top chord acted as an arch under the dead load of the bridge. Unfortunately, the resistance afforded by

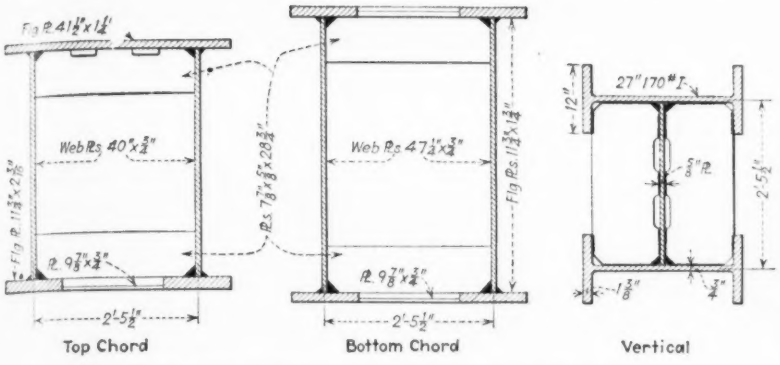

Fig. 2. Makeup of Vierendeel truss members on Hasselt bridge.

Fig. 3. Severed truss in panel where initial failure of bottom chord occurred. Note break in vertical member at lower field splice.

the abutments was insufficient to withstand the horizontal thrust of this arch, and when the top of one of the abutments failed by shearing, as shown in Fig. 1, the top chord broke as a simple beam.

No information is available on the details of the welding procedure. It is stated, however, that the steel contractor, although very capable, had had no previous experience with welded bridges, and that a number

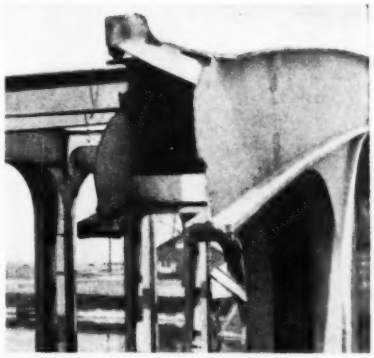

Fig. 4. Close-up of fracture in parent metal of top chord indicating brittle character of steel. Field splice beyond break.

of difficulties arose in developing a welding technique. However, these were overcome and the bridge finally completed and accepted.

The bridge was built under the direction of M. de Meyer, chief engineer, des Ponts et Chausses, by S. A. de Construction et des Ateliers de Willebroeck.

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Cleaning Up Sewage Plants

DURING WINTER MONTHS some minor matters at sewage treatment plants must be neglected or left undone but, (as pointed out in a bulletin of the South Dakota State Board of Health) with the approach of warmer weather it is desirable to get the plants in good operating condition. The winter accumulation of sludge must be disposed of, and the sludge beds cleaned and raked in readiness for the load they must soon receive. Any accumulation of refuse and rubbish around the plant must be removed. As the trickling filter will have its regular spring sloughing stage, the underdrains need to be checked to see that they are open and ready to accommodate this increased quantity of solid material. Floating sludge frozen in the gas vents of Imhoff tanks should be broken up to allow the sludge to resettle, the accumulated floating material being burned or buried.

"A few shrubs and trees, together with a nice lawn, will do much to make citizens aware of the sewage plant, and will attract more visitors. If the public realizes the important part played by sewage treatment plants in creating a sanitary environment, funds for its support will come more easily."

Notes on Sewage Disposal

A monthly summary of current developments conducted by Willem Rudolfs

DISTILLERY WASTES — Of the many methods proposed and tried for the treatment of distillery waste those utilizing biological means for stabilization of the liquors cause difficulties unless the wastes are diluted to a high degree. This requires extensive areas of trickling filters or large aeration tanks. In Germany some so-called "high-efficiency-trickling filters," consisting of closed structures filled with stone or slag through which air is either passed through with the flow or applied from the bottom against the flow, have been built. It is claimed that they perform well, stabilizing the material to a high degree. Meyer (*Vom Wasser*, XI, 163, 1937) discussing the operation of these filters states that only diluted material could be applied in which the B.O.D. was reduced from 206 to 24 p.p.m. However, these favorable results were obtained over only a short period. Difficulties occurred when the strength of the material varied, and at times the final B.O.D. was over 4,000 p.p.m. Mixing washwater with concentrated material having a B.O.D. of 10,000 p.p.m. to produce a mixture of about 6,800 p.p.m. the effluent had B.O.D. values of over 3,400 p.p.m. When not more than 250 gal. per day were applied per cu. yd. of filter, stabilization approached the desired results.

SEWAGE AS FERTILIZER—Interest has been renewed in the use of sewage sludge as fertilizer in this country as well as abroad. The value of sludge varies somewhat with the source, especially when trade wastes are present. In sewage treatment only a portion of the fertilizing value can be recovered and a considerable part of the nitrogen, phosphorus and potash remains in the liquid discharged. Studies made during the years 1935-36 at Berlin treatment plants by Böttcher (*Gesundheits-Ingenieur* 60, 330, 1937) show that the fertilizing value of sewage calculated on a per capita per day basis, amounts to 10 grams nitrogen, 2.5 gr. phosphoric acid and 6.5 gr. potash. Usually less than half is recovered in the sludge; when sludge is digested more is lost.

CHLORINE COMPOUND STUDIES —Although considerable work has been done on the effect of chlorine compounds on the sterilization of drinking water and the disinfection of sewage, and it is well known that the germicidal power of different compounds varies, the exact nature of the disinfecting action is still controversial. More information on the relative germicidal activity of various forms of chlorine, the effect of such factors as reaction (pH), organic matter in solution and suspension, temperature, time, contact, mixing, type of organisms, etc., is still needed. Charlton and Levine (Iowa Eng. Exp. Sta. *Bull.* 132, 1937) have taken steps in this direction, especially in regard to pH values and temperature, making use of bacterial spores. The action of hypochlorites was found to be markedly affected by changes in pH values—the more acid the reactions the greater the germicidal effect. For example, with 1,000 p.p.m. available chlorine at a reaction of pH 11.3, the killing time was 64 minutes, whereas at pH 7.3, the killing time was less than 20 seconds. With liquid chlorine no such effect seems to exist. With chloramine-T (a weak organic chlorine compound) the effect was found to be much less. Observations have indicated that in the presence of large quantities of alkali the effectiveness of chlorine is reduced.

SLUDGE DEWATERING—The heat treatment of sludge by the Porteous or wet carbonization process described in *ENR* (May 21, p. 739 and Dec. 10, p. 819, 1936), causes the bulk of the water content of the original sludge to separate. The cooking of sludge is attended by the passage of a considerable quantity of solid matter into solution and consequently decantrates of a greenish color, highly charged with nitrogenous organic matter, are obtained. Lumb and Hirst (*The Surveyor*, July 2, 16, 1937) have by measurement and analyses of the sludges, pressed cakes and liquors, calculated the proportion of the solid matter and total nitrogen taken into solution. The amounts dissolved were proportionately greater with sludges rich in nitrogen, the fraction being greater in activated sludge than raw primary sludge. Since the nitrogen of the sludge is reduced from 4 to 1.5–1.8 per cent, the cake is less suitable for fertilizer.

It is difficult to purify the decantrate, and means other than returning it to the sewage flow are being studied. In the case of liquors derived from secondary process sludges, satisfactory effluents could not be economically produced by single or double treatment of the diluted liquor, either by activated sludge or trickling filters. Single filtration of the diluted liquors, however, followed by return to the sewage flow, produced negligible increases in the B. O. D. of the final effluents from filters or activated sludge. It is estimated that 20 gal. per sq.yd. can be treated in trickling filters 6 ft. deep.

STORMWATER OVERFLOW — Where combined sewage must be treated, stormwater overflow chambers are desirable. This device must not operate until a predetermined amount of dilution is available and it should be self-cleansing, requiring a minimum of attention. Holden (*The Surveyor*, Dec. 24 1937) describes a chamber where the overflow sill has been so developed in length to obtain precise separation of flows without undue cost of construction. A long weir within the chamber has been obtained by using a side weir of the crenelated type. Cast iron troughs 10 in. deep are fixed to the side weir face and project into and overhang the main sewer. Five of the troughs are fixed by means of bolts into the sill at each side of the chamber. A clear space of about 6 in. is left between each trough and the floor of the chamber so that flow takes place beneath and around the troughs and thus sedimentation is minimized. The chamber is constructed on a 54 in. dia. sewer and passes 13 m.g.d. of sewage. The overflow passes one side of the chamber beneath the main sewer.

Am. Soc. C. E. at Jacksonville

Eight technical divisions of American Society of Civil Engineers hold sessions covering surveying, sanitation, beach erosion and highway problems of the coastal regions

AT THE SPRING MEETING of the American Society of Civil Engineers in Jacksonville, Fla., April 20 to 22, matters of general interest included the following topics: Water supply, malaria and pollution problems of the Southwest, beach and coast erosion, river and harbor improvements, the engineer's part in industrial development of the region, highway safety built into the roads, soil stabilization and use of local materials. A full day's session of the surveying and mapping division covered the usual problems of survey and title search, controls, and bringing old surveys into consonance with present-day lines of occupation. The sanitary, waterways and highways divisions all held full day sessions with attendance varying from 50 to 150. Probably greatest interest was shown in the waterways sessions which were augmented through joint participation by the American Shore and Beach Preservation Association.

Water supply

Groundwater is the main source of water supply for 200 of 220 cities of Florida and some serious warnings were given on the dangers of too heavy drafts by such cities as Jacksonville, where water in the former flowing wells has receded about 100 ft. The danger is from the likelihood of salt water and sulphates being drawn in. Opinions differed as to whether to expect its appearance to be gradual or sudden. The peculiar underground geology and water flow are as yet imperfectly understood. Until a great many more data have been accumulated definite answers can hardly be expected. Meanwhile the influx of industry has called for heavy demands and created pollution factors of moment.

Malcolm Pirnie in his paper on "Treatment and use of Artesian and Surface Water for Municipal and Industrial Purposes" indicated that there is plenty of water due to a high rainfall and ample groundwater storage. Advent of a new industry may overnight require more water than a population growth of 100,000 people. Quality needed may be different. Industrial requirements vary. Some are as follows: Bacterially safe, non-corrosive, freedom from turbidity, freedom from organic matter to prevent slime or foaming in boilers, low color, iron and manganese. The available waters vary greatly. Sarasota water has 1,000 p.p.m. solids and Charleston water is very low in solids. Tampa water is average in hardness. Orlando and West Palm Beach are soft and highly colored as are most surface waters. Sulphate is low at Daytona Beach, St. Petersburg and Savannah and high at Jacksonville and Brunswick.

Available data on runoff of Florida streams were covered in a paper by Donald S. Wallace, district engineer, U.S. Geological Survey. The flat topography with maximum altitude of 325 ft. and mean below 100 ft. presents conditions unlike those of any other state. Underlying rock is mainly limestone, soluble and permeable, thus giving it an important bearing on absorption and runoff. With its sandy cover most of Florida is a huge "filter bed." In consequence surface runoff is relatively low and groundwater runoff high. Abundance of lakes and swamps affect evaporation and regulate runoff intensity. Precipitation averages 53 in. Mean runoff per sq.mi. varies from 0.56 sec.-ft. to 1.65 but the maximum reaches 85.1 sec.-ft.! Florida is famous for springs, at least a dozen discharging 100 sec.-ft. or more.

Discussion on groundwater brought out that a move is under way to adopt legislation affecting its control. A bill to that effect, lost at the last legislature, will be brought up again. Many flowing wells are wasting one of the state's resources.

V. T. Stringfield, U. S. Geological Survey, cited four groundwater problems: Decline in yield, subsurface leakage from uncapped wells, intrusion of salt water. Planning is needed in development and conservation.

W. Austin Smith in commenting on the increased consumption following softening, indicated a 40 per cent increase at Hollywood and over 30 per cent at Live Oak and Miami.

Malaria control

Engineering factors involved in malaria control, as summed up by L. M. Clarkson, Georgia Department of Health, include elimination of borrowpits, correction of culvert elevations, supervision of impounding reservoirs of power plants, irrigation projects, street and road ditches, catch basins, ponds in private grounds and filling of ponds or covering them with oil or other larvicides, and proper screening of houses and construction camps. Much of malaria is man-made due to non-drained excavations. The engineer is responsible for prevention and control methods. Northern engineers, many of whom come South, should be trained in control procedure, in Mr. Clarkson's opinion.

Pollution

No industry, particularly a food industry such as that of supplying fish and shellfish, should be allowed to destroy another through pollution of water courses, according to L. M. Fisher, U. S. Public Health Service. However, the burden of waste disposal should not be so heavy as to put the industry out of business. Co-operation of industry with government was urged to seek satisfactory

methods of disposal of the industry's refuse.

In discussion, G. F. Catlett, Florida State Board of Health, stated that Florida streams are getting a serious overload but education of the public to the imminent dangers is slow, due to lack of funds. The public is apathetic in consequence. Comprehensive studies are needed.

Beach erosion

Col. Earl I. Brown, Corps of Engineers, U. S. Army, in a paper on "Beach and Coast Erosion," noted nine items to be investigated in considering the past history of a beach as follows: geology, shoreline changes, offshore changes, wind records, storm effects, type of protection works installed and their effectiveness, volume of sand made, tides, predominant direction of littoral drift. He cautioned against singling out any one or two of these items and drawing conclusions and recommendations therefrom. A vast amount of research is yet needed before protection can be reduced to a definite science in his opinion.

Movies of beach and coast erosion in the experimental wave tank at Fort Belvoir, Va., were shown by Capt. Frank O. Bowman, Corps of Engineers, U. S. Army.

In discussion of Capt. Bowman's paper, Col. G. A. Youngberg called attention to the predicament of the private owner of a short stretch of beach, to which the general studies of the Beach Erosion Board are not often applicable. He reviewed the many types of Florida beaches and alternate methods of handling them by steel groins, by sand-tight and permeable groins, and by compartmentalizing the beach. Individual problems at the St. Augustine Inlet, Upper Duval and St. James County beaches were noted. In commenting on steel groins the speaker took up attrition, corrosion and the rust resistance of copper-bearing steels. He felt that the Beach Erosion Board would do well to draft specifications for erosion-control methods after field investigations.

Col. Youngberg also read an exhaustive paper on the "Improvement of the St. Johns River and Harbor" wherein he reviewed the history and construction of the St. Johns River down to date, including the 24-ft. and 30-ft. projects to serve Jacksonville. Costs to date have run to $17,500,000, new work and maintenance being about equally divided.

"Beach Preservation Works at Winthrop Beach, Mass." was the subject of a detailed report by Richard K. Hale, Department of Public Works, Boston. The area is spotted with drumlins of boulders, clay, sand and gravel which make the "heads" for which the region is noted. There are 2,000 drumlins from 50 to 150 ft. high in the vicinity of Boston. Mr. Hale recited the experience with various types of walls and construction methods. Granite is the usual material.

Other papers on this program related to model studies on the Hell Gate Channel, wherein much money was saved through study of that irregular section of the East River; and studies on Galveston and Southern California beaches.

Highways

Charles M. Upham, engineer-director, American Road Builders Association, led off the sessions on highways with a paper on the highway industry's importance in the national economy. On diversion of gas taxes, he stressed the fact that the funds diverted, $200,000,000, were taken directly out of new construction monies since maintenance generally went on anyway. Diversions amount to 34 per cent of the entire highway construction program. Constitutional prohibition is the only effective means of bringing the misappropriations to an end. Our highway system is not completed, he said; some three-fourths of the 227,000 mi. of federal aid system needs improvement. Looking forward to 1960, Mr. Upham saw this mileage increased to 250,000. To reach this figure the annual program must be stepped up and there must be a shift to higher types. Highways supply the foundation for one-seventh of the national economy. One out of every seven persons gainfully employed is in highway transportation. There are 6,000,000 jobs involved.

"Building Safety in the Design and Construction of Highways," a paper by Harry J. Morrison, senior highway engineer, U. S. Bureau of Public Roads, related to experience in Florida with its flat terrain. Drainage, shoulders and slopes, grooved shoulders, right-of-way, lane widths and separations, limits of curves and superelevations, islands at intersections, reflectors, curbs, fencing school grounds and hazards due to cattle (Florida lets cattle run) are topics Mr. Morrison covered. Of novel interest were the following items: Bermuda grass builds up shoulders and holds water on the road. New concrete lanes outside of black top strips keeps vehicles away from the center whereas the motorist will hug a centerline on an all-concrete road. Superelevations to 0.08 per foot on 6-deg. curves are all that trucks loaded with fruit boxes or logs can negotiate. Rolling grades on long tangents are not objectionable but secondary rolls in grade must be limited so that vehicles will not disappear from the line of visibility. Omission of curbs at corners at filling stations is a pedestrian hazard.

J. H. Dowling, Florida state highway engineer, discussing local materials for roads, stated that lack of funds forces the state to use low-cost types and construction for great mileages. Materials for sand-clay roads are in evidence in all of the southeastern states, either found in nature or artificially combined.

B. P. McWhorter, U. S. Bureau of Public Roads, in discussion, stated that these states have a wider variety of local materials than any other section. He noted sand, clay, top soil, clay gravels, cherts, iron oxide, pebbles and lime rocks all have binding characteristics. In the commercial quarries are aggregates of granite, limestone, slags and gravels which are used extensively in concrete bases and pavements.

One of the principal functions of the South Carolina state highway laboratory is the testing of soils not only as bases for bituminous surface treatments but also as subgrade for rigid-type pavements, foundations for bridges and fill materials. W. H. Mills, Jr., testing engineer, Columbia, S. C., in his paper on "Soil Sampling and Testing," said that sampling is the most important and difficult part of the investigation, and added that it is not sufficiently stressed. He discussed the various standard tests of the A.A.S.H.O. and A.S.T.M., indicating that mechanical analysis is probably the most important test. Test for "swell" and percentage of mica would be of considerable value in some soils. Routine mica tests are almost prohibitive in cost however.

Concrete in Closed Chamber Protected Against Gas

Sewage in an unusually septic condition presents serious problems in a sump chamber

CONDITIONS unusually favorable to attacks on concrete by septic sewage gases obtain in a pump sump at Coronado Beach, a city adjoining San Diego, Calif. Sewage from this community is delivered in an 18-in. pipe to a closed chamber built of reinforced concrete whence the effluent is pumped into San Diego Bay. Flat grades, warm climate, and a high sulphate content in the domestic water supply combine to create a septic condition of the sewage in this chamber such that large volumes of hydrogen sulphide gas are generated.

Under these conditions serious deterioration of the concrete has occurred. Despite precautions in operation, it became apparent early last year that destruction of the sump chamber could be expected unless some better method of protection was found. Accordingly, a new method of protecting the concrete surface was employed and thus far indications are that it will effectively resist the gas attacks.

Sewage disposal plan

The pump sump which receives the effluent was built in 1931. It is a reinforced concrete structure circular in plan, about 20 ft. in diameter and 9 ft. deep, set in the ground at a level to which the sewage will flow by gravity. At one side is a rectangular chamber in which are located the pumps for forcing sewage from the chamber into the outfall when high tides make this necessary. The walls and ceiling of the chamber are 8 in. thick, built of well-graded aggregate using a 1:2:3 mix which produced a dense, strong concrete.

During periods of low tide this sump is not needed because the sewage then will flow by gravity through the outfall that discharges directly into the bay. As the tide rises, however, if it were not for this sump

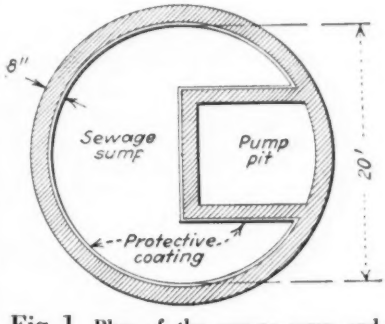

Fig. 1. Plan of the sewage sump and pump pit at Coronado Beach.

sewage would be backed up into the system, interfering with proper flow and creating an odor nuisance. In fact that was the situation before the sump was built. Under the present plan of operation the flow through the outfall is by gravity until the tide rises to a certain height. Then a gate closes automatically and diverts the sewage into the sump from which it is pumped out through the outfall against tidal pressure. The pumps are motor-driven and are automatically switched on and off as the level of sewage in the sump rises and falls in relation to tide level.

Tent City, a nearby suburban community, is located at such a low level that all of the sewage therefrom has to be collected in a sump below sea level. Sewage from this low level is pumped out, about twice a week, and discharged into the Coronado Beach sewer. Thus, in addition to the bad gases resultant from considerable periods of retention of Coronado Beach sewage, the septic condition in the sump is aggravated by the addition of the held-over discharges from the Tent City system.

When Coronado Beach built its sewage sump the sewer gas danger was recognized. Accordingly, the operating program from the outset included a thorough washing down of the walls and ceiling of the chamber once a week. Despite this regular cleaning out, after two years of service the interior surface of the concrete showed extensive deterioration. The surfaces were therefore thoroughly cleaned off with a wire brush and water pressure, and a half-inch plaster coat of cement mortar containing one part cement and two parts clean, sharp sand was applied. This expedient was not successful; in a short time the new surface showed signs of deterioration. The next resort was to a three-coat treatment of emulsified asphalt applied by pressure spray. This also failed to halt the attack, and early this year the reinforcing steel was exposed in places, indicating that ultimately complete destruction could be expected.

New protective coating

At this stage of the disintegration a contract was made for applying a protective coating called "Overcoat," a colorless solution of inert plastics in a volatile solvent, combined with finely graded silica. The application of this coating consisted of first brushing onto the concrete a penetrating primer and following with two air-spray applications of the coating, each about 1/16th in. thick and covered with a seal coat of the clear solution (without silica) painted on. As the work was done in an enclosed chamber, evaporation of the solvents made it necessary for the workmen to wear masks to which fresh air was delivered.

A 24-hr. drying period was allowed to elapse between application of the successive layers to permit the escape of solvents. Special care had to be used in applying each of the coatings to see that there were no pin holes; guarding against such holes was a major function of the clear coats which were brushed on over each application. The completed coating is about $\frac{1}{8}$ in. thick and presents a hard, smooth surface which has, however, a certain amount of inherent resiliency. It shows no tendency to shatter under impact but can be dented by the blows of a hammer. In the period of nearly a year that the new coating has been in service no indications of deterioration have appeared and city officials are hopeful that the problem of sewer gas attack has been solved.

Application of the protective coating was done under contract by the American Concrete & Steel Pipe Co., Los Angeles.

Setting Bids Against Costs

Oregon keeps costs to find the relationship between bid prices and actual costs on contract roadbuilding throughout the state

HAVING an inquiring cost accountant the Oregon state highway commission has been developing some interesting information on the relationship between contract prices and contract costs. Indeed the cost analyst, E. H. Clymer, has developed a real system of recording and comparing bids and costs. More important, he has created a relationship between the contractor, superintendent, foreman, bookkeeper, engineers and inspectors that brings close cooperation in the costkeeping task. This cooperation is required if instructive facts are to be obtained. Results, and not ways and means to them, are the subject of present consideration.

What is the information secured and how is it presented? First each contract is a separate cost-analysis operation. When the results are worked up they include a concise description of the job conditions and five tabulations of cost and other data broken down into work items and other units. An actual report is the best illustration. In presenting it identifying data have been eliminated or altered but otherwise the data are those of an actual contract operation.

The work described

Contract 2.840—This contract was bid and awarded in the spring of 1936. A camp with accommodations for 65 men was constructed. Clearing was started April 7, and excavation was started June 24. Good weather prevailed throughout the duration of the job, and excellent progress was made.

The job was situated in an isolated location in mountainous country accessible only by an old logging road which led in from a main highway a distance of 15 mi. The contractor improved this road at a cost of about $540, so that equipment and supplies could be brought in.

The clearing (41 acres) and grubbing (14 acres) was through heavy timber with a large number of old downfalls. The trees were fir, spruce and hemlock, varying in size from about 3 ft. to 7 ft. in diameter, with an average of about 90 trees per acre. The trees were felled so that they could be burned on the right-of-way. The trees were then limbed and drilled with a power drill. Explosives were used to split the logs up so that they would burn more readily. Some logs that did not lay

TABLE I — EQUIPMENT TIME AND RENTAL ALLOWED ON CONTRACTORS EQUIPMENT FOR ROAD GRADING JOB.

		Hours Worked		Rate per Unit	Total Charge
1	1¼-Yd. shovel	495 or	2 Mo. at	$800.00	$1,600.00
3	Ford V-8 trucks	1,447	at	0.50	723.50
2	International 3½ ton trucks	427	at	1.25	533.75
2	RD-8 95-hp. tractor	2,554 or	10 Mo. at	410.00	4,100.00
2	LeTourneau 12-yd. scrapers	2,520 or	10 Mo. at	315.00	3,150.00
1	RD-6 40-hp. tractor	1,653 or	7 Mo. at	190.00	1,330.00
1	Bulldozer for RD-6 tractor	550 or	3 Mo. at	70.00	210.00
1	Set double drums for RD-6 tractor	1,003 or	4 Mo. at	75.00	300.00
1	220-cu. ft. Denver compressor	590 or	3 Mo. at	235.00	705.00
2	Jackhammers	1,115 or	5 Mo. at	20.00	100.00
1	Electric welding machine		3 Mo. at	60.00	180.00
1	Ford V-8 pickup		6 Mo. at	40.00	240.00
1	Ford V-8 flatbed service truck		6 Mo. at	75.00	450.00
1	Set shop equipment		4 Mo. at	100.00	400.00
1	Pullblade 12-ft.		1 Mo. at	110.00	110.00
1	Heavy ripper		3 Mo. at	100.00	300.00
					$14,432.25

Equipment rental includes depreciation, repairs and equipment tax; also interest on equipment investment.

TABLE II — ITEMIZED COSTS OF LABOR, MATERIALS AND GENERAL SUPPLIES, MATERIALS AND SERVICES.

Labor:			
Supervision (superintendents & bookkeeper)			$3,449.45
Labor and foreman			34,593.62
Cooks and flunkies			3,284.74
State industrial accident insurance			1,898.11
Unemployment insurance			404.07
			$43,629.99
Material:			
12" Corr. iron pipe perf.	110 lin. ft.	at 1.02	$112.20
12" Corr. iron pipe bands	4 each	at 1.20	4.80
18" C. I. P. prot. invert	474 lin. ft.	at 1.47	696.78
18" C. I. P. bands	18 each	at 2.03	36.54
24" C. I. P. prot. invert	190 lin. ft.	at 2.30	437.00
24" C. I. P. bands	7 each	at 2.53	17.71
48" C. I. P. prot. invert	110 lin. ft.	at 5.59	614.90
48" C. I. P. bands	4 each	at 4.96	19.84
18" concrete pipe	520 lin. ft.	at 1.74	904.80
24" concrete pipe	190 lin. ft.	at 2.28	433.20
Cement for pipe joints	3 sacks	at 0.80	2.40
Sand for pipe joints	4 sacks	at 0.25	1.00
			$3,281.17
Equipment rental, supplies and miscellaneous:			
Equipment rental			$14,432.25
Gas, oil and grease			4,137.43
Explosives used on clearing and grubbing			3,419.40
Explosives used on solid rock excavation			2,817.00
Freight and cartage moving equipment in and out			1,074.80
Lumber and material for camp construction			1,079.48
Cookhouse and camp supplies			7,498.10
Drill steel, bits and drilling supplies			822.60
Small tools, supplies and miscellaneous			3,376.53
Horse hire and horse feed			495.02
Bond 1% of gross revenue			962.55
Home office and general overhead			2,255.00
Sold camp buildings when through with job — credit			(350.00)
			$42,140.16
Cost grand total			$89,051.32

Table III—Set-up of Ledger Showing Distribution of Cost Items to Various Work Operations and Construction Materials

	Labor	Material	Miscellaneous	Total	Supervision (*P*)	Clear and Grub	Danger Trees	Trench Excavation	Common Excavation	Solid Excavation	Truck Haul	Overhaul
Payrolls	$41,327.81			$41,327.81	$3,449.25	$19,344.15	$661.20	$520.80	4,831.69	$5,038.47	$1,109.96	
State industrial	1,898.11			1,898.11	68.98	967.21	33.06	26.04	241.58	279.67	55.50	
Unemployment insurance	404.07			404.07	24.29	193.44	6.61	5.21	48.32	50.38	11.10	
Equipment rental			$14,432.25	14,432.25	240.00	1,060.00			6,902.00	3,485.00	1,257.25	
Diesel oil, gas, oil and grease			4,157.43	4,157.43	210.50	554.20			1,224.23	814.00	778.80	
Explosives, clearing			3,419.40	3,419.40		3,419.40						
Explosives, solid			2,817.00	2,817.00						2,817.00		
Drill steel, bits and drilling supplies			822.60	822.60						822.60		
Lumber and material for camp construction			1,079.48	1,079.48								
Small tools and miscellaneous supplies			3,376.53	3,376.53	128.40	815.70	17.50	28.80	577.50	667.75	323.10	
Horse hire and feed			495.02	495.02		495.02						
Freight and cartage moving equipment			1,174.80	1,174.80		75.00			285.00	629.80	120.00	
Cookhouse and camp supplies			7,498.10	7,498.10								
Bond 1 per cent of gross revenue			962.55	962.55		348.50	7.60	8.60	310.38	165.24	50.76	
Home office and general overhead			2,255.00	2,255.00	2,255.00							
Culvert pipe		$3,277.77		3,277.77								
Cement and sand for pipe joints		3.40		3.40								
Credit — sold camp when thru			(350.00)	(350.00)								
TOTAL	$43,629.99	$3,281.17	$42,140.16	$89,051.32	$6,376.42	$27,272.62	$725.97	$589.45	$14,420.70	$14,770.91	$3,706.47	
$930.00 of camp cost chargeable to cookhouse and lodging				16.4%								
Prorate proratable Expense according to cost not including Materials					(6,376.42)	4,472.71	119.06	96.67	2,376.74	2,452.11	607.86	
Overhaul cost figured from time study									(1,965.73)	(1,671.44)		$3,637.17
TOTAL	$43,629.99	$3,281.17	$42,140.16	$89,051.32	0.00	$31,745.33	$845.03	$686.12	$14,831.71	$15,551.58	$4,314.33	$3,637.17

	Finishing Roadbed and Slopes	Rounding Cuthanks	12" Pref. C.I.P.	18" C.I.P.	24" C.I.P.	48" C.I.P	18" Concrete Pipe	24" Concrete Pipe	Camp Construction (*P*)	Cookhouse and Lodging	Service Truck and Shop (*P*)	Improve 10-mile Road to Job (*P*)
Payrolls	$385.20	$534.10	$14.35	$162.50	$88.70	$164.60	$155.20	$127.90	$435.25	$2,084.74	$1,009.66	$210.15
State industrial	19.26	26.71	.72	8.13	4.43	8.23	7.76	6.40	21.76	61.68	50.48	10.51
Unemployment insurance	3.85	5.34	.14	1.62	.89	1.65	1.55	1.28	4.35	30.85	10.10	2.10
Equipment rental	210.00					8.00					1,030.00	240.00
Diesel oil, gas, oil and grease	74.20					3.50					420.00	78.00
Explosives, clearing												
Explosives, solid												
Steel												
Camp construction									1,079.48			
Small tools	22.40	15.00									780.38	
Horse hire and feed												
Freight	20.00									45.00		
Cookhouse										7,498.10		
Bond	11.50	11.31	1.65	9.48	5.70	12.65	13.00	6.18				
Home office												
Culvert pipe			117.00	733.32	454.71	634.74	904.80	433.20				
Cement							2.20	1.20				
Credit									(350.00)			
Total	$746.41	$592.46	$133.86	$915.05	$554.43	$833.37	$1,084.51	$576.16	$1,190.84	$10,726.37	$3,300.56	$540.76
Camp Expense chargeable to cookhouse									(930.00)	930.00		
Proratables	122.41	97.16	2.78	29.80	16.35	32.57	29.11	23.25				
Proratables									(260.84)		(3,300.56	(540.76)
TOTAL	$868.82	$689.62	$136.64	$944.85	$570.78	$865.94	$1,113.62	$599.41	$0.00	$11,656.37	$0.00	$0.00

(*P*) = Proratable expense.

TABLE IV — COSTS BY ITEMS COMPARED WITH BID PRICES AND ESTIMATE OF PROFIT.

Item	Cost	Quantity	Unit Cost	Unit Bid	Gross Revenue
Clearing and grubbing	$31,745.33	41 acres	$774.27	$850.00	$34,850.00
Felling danger trees	845.03	1,510 sq. ft.	0.56	0.50	760.00
Trench excavation	686.12	860 cu. yd.	0.80	1.00	860.00
Common excavation	14,831.71	119,374 cu. yd.	0.124	0.26	31,037.24
Solid rock excavation	15,551.58	44,661 cu. yd.	0.348	0.26	11,611.86
Overhaul	3,637.17	245,615 yd. sta.	0.015	0.02	4,912.30
Truck haul	4,314.33	25,381 yd. mi.	0.17	0.20	5,076.20
Finishing roadbed and slopes	868.82	2.3 Miles	377.75	500.00	1,150.00
Rounding cutbanks	689.62	11,314 lin. ft.	0.06	0.10	1,131.40
12" perf. corr. iron pipe	136.64	110 lin. ft.	1.24	1.50	165.00
18" C. I. P. protected invert	944.85	474 lin. ft.	1.99	2.00	948.00
24" C. I. P. protected invert	570.78	190 lin. ft.	3.00	3.00	570.00
48" C. I. P. protected invert	865.94	110 lin. ft.	7.87	11.50	1,265.00
18" Concrete pipe	1,113.62	520 lin. ft.	2.14	2.50	1,300.00
24" Concrete pipe	599.41	190 lin. ft.	3.15	3.25	617.50
Subtotal					$96,254.50
Mess house and lodging	11,650.37	8,496 man days	1.37	1.00	8,496.00
Total	$89,051.32				$104,750.50

Gross revenue	$104,750.50
Total, cost	89,051.32
Net profit	$15,699.18

Net profit equals 15 per cent of gross revenue.

right were bucked and pulled into a windrow with a 40 hp. tractor equipped with drums and with two teams; 5½ tons of explosive was used to split up the logs. It was not necessary to grub stumps that would be buried more than 3 ft. in the fills; 14 acres of stumps were grubbed, but on 27 acres it was not necessary to grub. The stumps were shot, then pulled with the 40-hp. tractor, and burned; 10½ tons of explosives were used on grubbing. The cost of clearing was about $650 per acre, and the cost of grubbing was about $360 per acre.

Trench excavation was by hand labor. Picks were required on about 50 cu. yd.

The common excavation was moved with two 95-hp. tractors and two 12-yd. scrapers. Grading was not started until late June, and the soil was dry enough to excavate easily with scrapers; 119,374 cu. yd. of common was excavated and moved an average distance of 1,200 ft. in 2,520 scraper operating hours, an average of 47 cu. yd. per hour for each scraper. The equipment was new, and excellent progress was made; three 7-hr. shifts operated 21 hr. per day.

The solid excavation consisted of shale, basalt and a blue rock that slacked when exposed to the air. The blue rock, about 8,000 cu. yd., broke large and was hard to handle, but the shale and basalt, which constituted the largest part of the solid, broke up fine and about 8,500 cu. yd. was used for topping. Only 16,500 lb. of explosive was used to blast 44,661 cu. yd. of solid, an average of only 0.37 lb. per cu. yd. The cost of drilling and blasting was only $0.145 per cu. yd., as it was only necessary to shake a large part of the solid excavation lightly.

The solid material was loaded with a 1¼ cu. yd. shovel into five 3½-ton trucks and hauled an average distance of 1,800 ft. The shovel made fine progress, loading 44,661 cu. yd. in 495 hr., an average of 90 cu. yd. per hour shovel operating time.

A crew of about 60 men working one 8-hr. shift per day finished the clearing and grubbing in about 3 months. Three 7-hr. shifts per day were worked on grading. One 1½ yd. shovel and two 12-yd. scrapers moved 164,000 cu. yd. of excavation in 3½ months.

The wage scale was $0.50 for common labor, $0.75 for intermediate labor and $1.20 for skilled labor.

Cost records

Efficient management with modern equipment resulted in a fair profit as shown by the tabulated cost records (Tables I to IV). These include besides the equipment rental sheet an itemized ledger set-up, a summary of costs and a comparison of costs with bid prices and an estimate of profit.

An Inter-Terminal Railway at Brussels

A SIX-TRACK SUBWAY 6,400 ft. long, with approach viaducts 660 and 6,230 ft. long, is under construction at Brussels by the Belgian government to connect the present stub terminals of the North Station and the South Station. The latter will be the main terminal, having 22 tracks, of which ten will be stub and the others through tracks, while the North Station will have 12 through tracks.

The subway, built as cut-and-cover in an excavation 115 ft. wide, with steel sheeting to retain the sides, will have three double-track sections, 31 ft. c. to c. of columns, and a narrow section at one side for a concrete drain or sewer and for ventilating conduits. An unusual feature is the provision of garage space over the subway roof. In the subway, the headroom is 17 ft. 9 in. above the rails; the garage space is 10 ft. 2 in. high from floor to ceiling.

The structural frame consists of five-column steel bents spaced 25 ft. apart, with longitudinal I-beams at the roof level of the subway and of the garage. Other I-beams, laid flatwise, are fitted between the outer columns and the steel sheeting. The roofs, sides and floor are of reinforced-concrete, the floor being a deep slab. Heavy waterproofing courses are placed outside of the masonry. In construction, shafts for the columns were sunk to a depth of 5 ft. below the floor level, and concrete footings were placed. When the columns were seated, three lines of transverse bracing were placed between them as the excavation was carried down. The two upper lines were permanent, forming the roofs of subway and garage, but the lowest set was removed after the floor had been completed. The braces were continued beyond the outer columns so as to bear against the sheet piling. This work was done in lengths of about 80 ft.

Trains on the line

Regular traffic is estimated at 300 trains daily. Although the line will be operated by electric trains, a number of steam locomotives will have to be run, and a combination of forced and induced draft has been designed for the ventilating system. From a duct between the tracks of each double-track section, the air will be drawn downward into transverse ducts leading to a main longitudinal conduit. Fresh air will enter at the roof level. A boulevard is to be built over the line of the subway to facilitate vehicle traffic between the terminals and to relieve other main thoroughfares.

THE WEEK'S EVENTS

Continued from page 639

California Road Damage Totals $8,000,000

Damage to California highways during the storm of last Feb. 28–March 5 totaled $4,500,000, the state department of public works has announced. This storm, in conjunction with storms in early February and in December, inflicted a total damage of $8,000,000 on state highways within three-months.

Since the cost of repair was beyond the scope of the contingency fund, repairs are being financed from funds normally allocated for slide removal, from contributions from emergency federal relief funds, and from money secured by postponing budgeted construction projects. The majority of the repair work will be performed by contract, and much of it is now being advertised for bids.

The brunt of the storm was borne by Los Angeles, Orange, Riverside, Ventura, and San Bernardino counties. Worst damage occurred on the highways leading to the Lake Arrowhead, Big Bear Lake and Barton Flats resort areas, on the Angeles Crest route north of Pasadena, and along the San Gabriel canyon north of Azuza. In the valley areas the heaviest damage occurred where the Santa Ana and Santa Clara Rivers cross highways. Many of the bridges in this area were washed away, and new channels were created isolating some structures. Most of the bridges lost were early county structures located on roads later taken into the state highway system. Structures designed by the highway system along these streams resisted the floods adequately, according to the department.

Flood Control Work

With a $6,500,000 appropriation for flood control work in Los Angeles county already passed by the House of Representatives and additional funds expected from relief money designated for flood control, plans are being made for new control works in the Los Angeles area. Principal project contemplated is the $3,000,000 Hansen retarding basin, an earth fill dam on Tujunga Wash, the overflow of which caused heavy damage.

Additional projects planned with relief funds are the Van Nuys retarding basin, a 15,000 ft. long earth-fill dam on the upper Los Angeles River, and the Santa Fe retarding basin, an earth-fill dam on the San Gabriel.

San Diego to Vote On Canal Contract

The city council of San Diego has decided to place before the voters the questions of ratification of the city's contract for participation in the cost of the All-American Canal and approval of a bond issue for construction of San Vicente Dam and reservoir. In taking this action, the council is following recommendations of a citizens fact-finding committee which were submitted to the city manager March 4.

Pointing out that some time before 1970 the city will find it necessary to draw water from the Colorado River and that the city has already made arrangements to use part of the storage of Boulder Dam, the committee recommended that the city participate in the cost of the All-American Canal, thus procuring the right to use the canal for delivery of Colorado River water to the city and at the same time protecting the city's rights to Colorado water by complying with the legal requirements of using "due diligence" in procuring means to obtain it. Participation in the cost of the canal would take the form of paying a percentage of the total cost proportionate to the percentage of canal capacity which would be available to the city, about 1.5 per cent.

To meet present needs, the committee recommended immediate construction of the San Vincente reservoir to develop local water supplies. Priority over the Super-Hodges and Mission No. 2 dams was given to San Vincente because of its comparatively low capital cost and because the city already owns the dam and reservoir site.

An abstract of the engineers' report on the San Diego water situation was published in *ENR*, June 17, 1937, p. 908.

BRIEF NEWS

BUENOS AIRES PROVINCE, Argentina, will shortly ask bids on the first portion of a 20,000,000 four-year road program which, when finished, will add 2,600 kilometers of concrete highways to the existing system.

FORMATION of a city planning body in Baltimore which would have broad powers in connection with the development of the city has been recommended by a special committee appointed by Mayor Jackson to study the subject.

REGULATION of motor carriers in New York State by the state Public Service Commission is provided for in a bill which has been signed by Governor Lehman.

AARON W. SHERWOOD, claiming that his position as assistant division engineer in the Ohio state highway department was not abolished in good faith, has asked the county court of appeals to compel the state highway director to restore him to his position. Sherwood was appointed under civil service in 1926, and his position was abolished a year ago on the grounds of lack of work. He says that at that time there was considerable work under way and that non-civil service persons are now performing his duties.

EXEMPTION from Mexican import duties has been ordered for construction machinery and equipment required for flood control work of the Mexican government on the Rio Grande.

A CITY-WIDE campaign to condemn unsafe buildings in the city of Columbus has been launched by building, fire, and fire inspection officials. The campaign will also include a demand for the repair of many structures now in an unsafe condition.

OFFICIAL opening of the Key West Overseas Highway connecting Key West with the mainland of Florida will be held on July 4. Some traffic is now using the highway.

A LICENSING ORDINANCE for Akron contractors was defeated by the city council April 18. The ordinance would have required a license for contractors on all jobs over $1,000.

THE CONFERENCE for timber utilization which was to have been held in July at Vienna by the Department for Timber Utilization of the Committee Internationale du Bois has been postponed due to the transfer of the headquarters of the C.I.B. to a west European capital. The conference will probably be held in September.

AN INTERNATIONAL building club of a semi-social nature is being organized in London and is soliciting American members. Its president, Sir Harold Bellman, has temporary offices at 35 Basildon Court, Devonshire St., W. 1, England.

AWARDS in the 1937 city health conservation contest have been made by the Chamber of Commerce and the American Public Health Association to the following cities in their respective size classes: Boston; Louisville and Providence; Hartford; Sacramento; Greenwich, Conn.; Englewood, N. J.

CALENDAR OF MEETINGS

NATIONAL SOCIETIES

NATIONAL LIME ASSOCIATION, annual convention, Netherland-Plaza Hotel, Cincinnati, May 9-10.

NATIONAL FIRE PROTECTION ASSOCIATION, annual meeting, Chalfonte-Haddon Hall, Atlantic City, May 9-12.

AMERICAN ROAD BUILDERS ASSOCIATION, annual meeting, Willard Hotel, Washington, D. C. May 11-13.

ASSOCIATED GENERAL CONTRACTORS OF AMERICA, spring board meeting, French Lick, Ind., May 16-18.

AMERICAN SOCIETY FOR TESTING MATERIALS, annual meeting, Chalfonte-Haddon Hall, Atlantic City, June 27-July 1.

SOCIETY FOR THE PROMOTION OF ENGINEERING EDUCATION, annual meeting, Texas A. & M. College, College Station, Texas, June 27-30.

AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS, summer convention, Washington, D. C., June 20-24.

REGIONAL AND LOCAL

PENNSYLVANIA STATE COLLEGE, School of Engineering, annual industrial conference, State College, Pa., May 11-13.

MARYLAND-DELAWARE WATER AND SEWERAGE ASSOCIATION, annual conference, Emerson Hotel, Baltimore, May 19-20.

SECTION MEETINGS, American Water Works Association:
Pacific Northwest, Spokane, May 19-21.

NEW YORK STATE SOCIETY OF PROFESSIONAL ENGINEERS, annual meeting, Hotel Commodore, New York City, May 20-21.

PENNSYLVANIA SEWAGE WORKS ASSOCIATION, annual conference, State College, Pa., June 8-10.

ELECTIONS AND ACTIVITIES

THE OFFICES of the Concrete Reinforcing Steel Institute and the Steel Joist Institute have been moved from 201 N. Wells St., Chicago, to the Builders Building, Chicago.

ROBERT BARKER was elected president of the Rhode Island Highway Association at its annual meeting last month. Other officers are: Clarence Thurber and Thomas Tracy, vice presidents; John V. Keily, secretary-treasurer.

JAMES FAIRMAN has been elected president of the Kings County Society of Professional Engineers of Kings County, N. Y. Other officers elected were: Louis A. Walsh, vice president; George A. Dorfman, secretary; Otto Clausner, treasurer.

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License Examination

LOUISIANA, personal appearance of applicants for registration of civil engineers and surveyors May 18; written examinations May 19-20.

OBITUARY

RICHARD T. WISDA, for the past four years an engineer in the bureau of construction of the Ohio highway department and formerly director of public works in that state died in Columbus, April 15, at the age of 56. Wisda, who served in the Engineers Corps during the war and had been county engineer of Defiance County, Ohio, entered the state service in 1923 when he became assistant superintendent of the division of public works, then a part of the highway department. When the two were separated, he was made director of the new department and served in that capacity under several governors. Later he was division engineer at Toledo for the highway department.

JOHN W. BAKER, who was for many year an engineer in the city service of Portland, Oregon, died there April 20 at the age of 70.

ROBERT S. BLACKFORD, retired, who was a civil engineer in the county surveyor's office in Columbus, Ohio, for 40 years, died April 21 in Columbus at the age of 68.

DANIEL S. BELL, Boston contractor and former president of the John Palmer Co. died suddenly of a heart attack while on a construction job in Groton, Mass. April 20. Bell was 59 years old.

CHARLES F. PRETTIE, 73, for 25 years superintendent of erection of the Canadian Bridge Co. died recently in St. Petersburg, Fla.

ADHEMAR MAILHIOT, dean of L'Ecole Polytechnique at Montreal died there April 22, aged 55. Mailhiot had been registrar of the Corporation of Professional Engineers of Quebec since the organization of that body in 1921.

CAPT. WALTER H. ALLEN of the Navy Civil Engineer Corps, Public Works Officer of the 12th Naval District, died in San Francisco April 19 at the age of 63. Allen, a graduate of Yale University and Sheffield Scientific School also studied at Yale Graduate School. He completed his studies in 1898 and for the next five years was engaged in railroad work in New England and Mexico. He was appointed to the Civil Engineer Corps of the Navy in 1903. His recent assignments included duty at the naval operating base in Hampton Roads and the 5th Naval District from 1926 until 1930, four years service as design manager for the Bureau of Yards and Docks, and service as war plans officer from 1934 to 1936. He had been on duty in San Francisco since 1936.

DANIEL BRECK, 75, president of the St. Louis firm, Selden-Breck Construction Co., and connected with that firm for the past 33 years, died in St. Louis April 22. Breck graduated from Central University in 1882, and after doing graduate work at the University of California he served on the Colorado mountain survey of the U. S. Geodetic Survey from 1883 to 1885. For the next 18 years he was engaged in railroad work for the Pacific Coast R.R., the Louisville & Nashville, the Oregon, and the Navigation Railroad Co. In 1901 he was made general superintendent of the St. Louis Terminal Ry. and two years later was a co-founder of the Selden-Breck company.

AMBROSE G. GRANDPRE, Chicago structural engineer, died April 24 in Chicago at the age of 53. Grandpre had built numerous theatres and office buildings in the Chicago Loop.

CLAUDE BARTHALOW, 29, an engineer for the U. S. Engineer Corps, drowned in the Mississippi River near Quincy, Ill., when a rowboat, in which he was doing survey work capsized.

DAVID H. FLEMING, consulting engineer for the City of Toronto, who had been assistant city engineer of St. Catharines and city engineer at Owen Sound, died recently in Toronto.

JOHN H. KILMER, a civil engineer and a founder of the British Columbia Institute of Civil Engineers, died recently in Port Coquitlam, B. C.

RODERICK L. FUHR, 61, construction engineer in Cleveland for the Thompson-Starrett Construction Co. for 18 years, died there recently.

WILLIAM KENNEDY, president of the Brooklyn-New York firm, William Kenedy Construction Co., died April 28 in Brooklyn at the age of 72. Buildings erected by Kennedy's firm include the Williamsburg Savings Bank, the $5,000,000 Broadway Temple, the Bronx County Court House and the Brooklyn Central Courts. The firm also built power plants throughout the country for Westinghouse.